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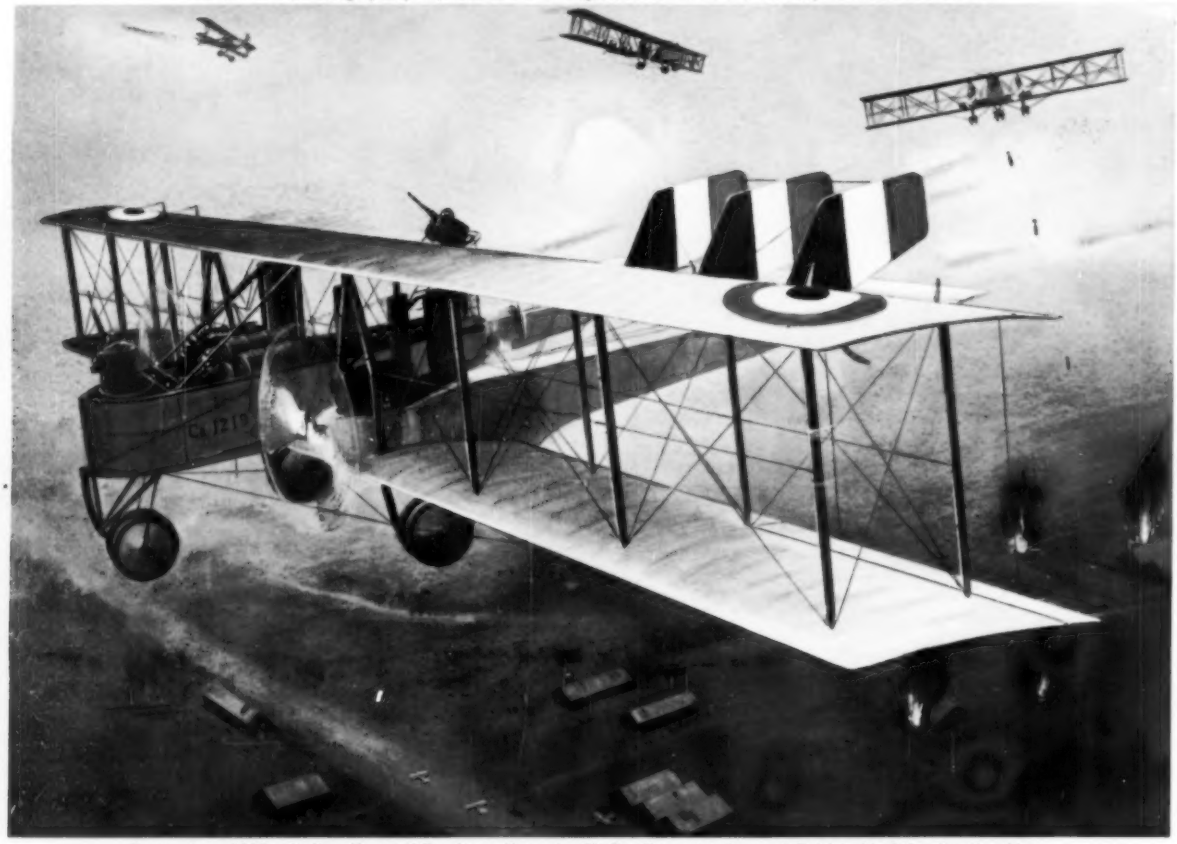

September, 1918—Italian Caproni Bombers, flown by U. S. pilots, attack an airfield behind the Austrian Lines.

Early War Birds— THE CAPRONI CA 33 BOMBER

This World War I plane attests to Italian leadership in the early development of heavy aircraft. Evolving from the 1914 Caproni Ca 31 (one of the first successful trimotors), the Ca 33 was used extensively on the Italian Front from 1916 until the Armistice . . . and in small numbers on the Western Front during 1918. When powered by three 180-horsepower Isotta Fraschini engines, the Ca 33 had a top speed of around 85 mph, a service ceiling of 16,000 feet, and an endurance of 6 hours. It was manned by a crew of four—pilot-bombardier, co-pilot, forward observer-gunner, and rear gunner. It carried from 800 to 1000 pounds of bombs and was armed with two to four machine guns.

After the United States entered the war, a number of Americans, under command of Major Fiorello LaGuardia, were trained in Italy and attached to Italian bombardment squadrons. From June, 1918, until the Armistice, these U.S. pilots took part in some 65 missions with their Italian allies.

On one such mission, 20 Capronis and their escort planes took off from a field near Padua to bomb an enemy airdrome some 20 kilometers behind the lines. Flying along the Adriatic coast northeast of Venice, they skirted the Austrian trenches and arrived over the target undetected. As the Capronis finished their bomb runs and were making for home, they were jumped by enemy "fighters." In the ensuing engagement, the Ca 33 piloted by an American, Lt. Willis Fitch, was hard hit. Like angry hornets, the enemy single-seaters swarmed around his Caproni. The center engine was shot up . . . and an observer seriously wounded. Fitch scrambled forward and, taking over the observer's guns, managed to shoot down one of the attackers. Finally, the enemy was driven off by the escort planes . . . and Fitch's Caproni limped home on two engines, with shot-up control surfaces barely functioning.

Lt. Fitch flew more missions, and was twice decorated by the Italians. LaGuardia, too, flew many missions and was decorated. They came home, but many did not.

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NOVEMBER, 1961
VOLUME 69, NUMBER 5

COVER: Number-one nacelle of the Henri Potez 840 juts starkly across November's cover, carrying one of the four Turbomeca Astazou 530-shp turboprops. Scheduled for a 1962 tour of the U.S., the 16-passenger executive version cruises at 313 mph at 20,000 feet, has a range of 2,000 miles. (Photo by R. I. Stanfield.)

CONTENTS

GENERAL AVIATION SURVEY & FORECAST
Including Specification and Performance Tables

FIXED-WING AIRCRAFT	22	*Flying Staff*
ROTARY-WING AIRCRAFT	27	*Flying Staff*
PISTON AND TURBINE POWERPLANTS	30	*Flying Staff*
NAVCOM EQUIPMENT	34	*Flying Staff*
SUPPORT EQUIPMENT	40	*Flying Staff*
WHY AIRCRAFT COST MONEY	42	*Robert I. Stanfield*
NATIONAL SOARING CHAMPIONSHIPS	46	*William P. Stewart*
AVIATION FUELS, PART II	48	*Richard B. Weeghman*
PILOT REPORT: CANADAIR'S CL-41 LIGHT JET TRAINER	50	*Richard Bach*
AG FLYING: OPPORTUNITY FOR PILOTS	52	*Murray A. Kahn*
BUSINESS FLYING IN CANADA	54	*James Montagnes*
LIGHT TWIN FLIGHT PROFICIENCY	56	*Ted Durosko*
NORTH AMERICAN AVIATION, PART III	58	*Gill Robb Wilson*
NEEDED—A BETTER PROGRAM FOR OUR AIRPORTS	60	*Frank A. Hand*
ACROSS THE NORTH ATLANTIC IN A MOONEY	62	*Walter Moody*
WHO BUYS, WHO FLIES, AND WHY?	64	*Leslie L. Thomason*
PILOT REPORT: VOLPAR TRI-GEAR TWIN BEECH	66	*Richard L. Sweeney*
ARE TRADE SHOWS NECESSARY?	68	*Lou Davis*
THINGS WITH WINGS	70	*Robert Straub*
TIPS ON AVIATION INSURANCE	71	*James H. Winchester*
BOEING'S VARIABLE SWEEP WING AIRPLANE	72	*J. S. Butz Jr.*
THE OLDER PILOT	73	*John T. Flynn, M.D.*
LUCK OF THE IRISH	76	*Maj. James Fitzmaurice*
HORIZONS IN PRIVATE FLIGHT	77	*Igor Bensen*
SERVICE CITY, USA	104	*Flying Staff*

FLYING FEATURES

Mailbox	4	EDITORIAL	20
Briefings	8	Airman's World	45
New Products	10	Flying Newsreel	74
Who and Where	12	I Learned About Flying From That	78
Have You Read?	18	Thrust Lever	80
Advertising Index	158	Flying Calendar	158
		Picture Credits	158

TURN THE PAGES of this special issue to find reflected new industry developments and designs . . . key details of new aircraft, powerplants, navcom and support equipment. All are geared to needs and requirements of the personal, commercial and business pilot. And all point up a FLYING fact—General Aviation Is On The Move.

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WINGS and THINGS

With each of this issue's general aviation articles covering the latest developments in its own field, it is fitting that this month's column feature the following special message from FAA Administrator, Najeeb E. Halaby.

GENERAL AVIATION is the fastest growing segment of the aviation community, and we expect this growth to continue over the coming decade. It will be stimulated by ever increasing recognition of the airplane's value as both a business tool and a pleasure vehicle.

By 1970, general aviation flying is expected to increase from the 12,200,000 hours flown last year to about 18,000,000 hours. At the same time, the mix is expected to shift, with personal flying rising from its present 25 per cent share to a full third of the total hours. Executive and commercial flying are expected to grow at a substantial rate, with instructional flying increasing at a somewhat slower pace. At the end of this decade, general aviation will account for about 65 per cent of all flying hours.

During this same period, the general aviation fleet is expected to grow from the current level of 76,000 aircraft to 105,000—85 per cent of all the aircraft in the nation.

General aviation aircraft manufacturers shipped 7,588 airplanes, including exports, in 1960. They had a total value of $151,220,000, an average cost of approximately $20,000 each. This production will increase, and it means not only that the fleet is increasing in size, but in quality as well. About half of it now consists of the larger single-engine planes with four or more seats and of multi-engine types.

As the fleet increases, it also will gradually change in character as newer type aircraft become truly practical vehicles. More small jet airplanes will be flying, and there will be more helicopters in use. But the greatest growth is expected in small piston-engine aircraft. The whole general aviation fleet is expected to be better instrumented as the years go by.

With the increase in activity, there is a corresponding need for more ground facilities to handle it. This is where general aviation's tremendous growth trend runs into conflict with the capacity of general aviation airports. The country will need an additional 150 airports in this category over the next ten years, and if they are not provided, growth may be impeded simply because there won't be enough airports to handle it.

We in the Federal Aviation Agency share the general aviation community's concern over the airport situation, and we will contribute to the (Continued on page 108)

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MAILBOX

CORRECT USE OF ADF

I have read and enjoyed L. W. Reithmaier's article (August issue) "Improve Your ADFability". A good clear and concise article on ADF is very unusual, as very little good text material has been written, or published, on the proper use of ADF.

I wish to differ technically with the statement on page 45 that "In ADF work, heading is compass heading". To work correctly with ADF, compass headings should not be used. Magnetic headings should be used, thus eliminating the compass deviation error which on some compasses can be rather large.

The magnetic heading plus the ADF relative bearing equals magnetic bearing. True heading plus ADF relative bearing equal true bearing. To add the ADF relative bearing to the CH results in a compass bearing which should only be used when the magnetic heading and CH are the same. In other words, when the compass deviation error is zero. Most compasses have some error on all headings so compass bearings normally should not be used in ADF work.

On the same page Mr. Reithmaier states "You cannot home away from a station." This is true most of the time so basically the statement is true. To be completely correct he should say that homing away from a station is possible under three conditions: where there is no wind, or where there is a headwind or tailwind blowing exactly along the intended track. Since these conditions seldom exist, homing from is usually not possible and a pilot must be able to ADF track.

The article was very good and should be helpful to all pilots who will take time to read it.

H. M. Gibson

Ft. Worth, Texas.

MOTION SICKNESS

. . . Referring to Dr. John T. Flynn's "Motion Sickness" in the July issue, I found the article very informative and unusually factual. I feel this is a problem that should be mentioned more often and perhaps in more different ways—especially in view of the many people who are continually coming into contact with flying for the first time. . . . His observations were better than my own and helped me add to my storehouse of motion sickness information.

It has given me a great amount of discomfort to hear some old time pilots, and some who are not so old, lump their description of airsickness in a single word. Fear. Doubtless this attitude has driven more people away from flying than those who are trying to promote it will ever realize. Strangely, to admit feelings of motion sickness is to admit you're not quite normal.

. . . I have been *airsick* now and then for over 30 years. I've been *motion sick* in cars, busses, boats and ships. . . . This has little to do with conscious fear.

I rode out a hurricane in the North Pacific on an APA and I was scared stiff. Two destroyers capsized in the same hurricane. I wasn't sick. While swinging on the hook aboard the USS Appalachian at Saipan, I woke up one morning very sick from motion. I was almost airsick when I passed my private pilots flight test. This was mostly caused by an aerobatic maneuver the examiner playfully started but never finished.

The more I work with a motion sickness producing machine, the less this bothers me and I don't intend letting it drive me from anything I enjoy doing.

Frank Stone

Hermiston, Ore.

EDITORIALS

Just a note to congratulate you for your superbly written editorial "A Weapon for the Free".

I am certainly no connoisseur of advanced thinking, but I've read everything from "Confidential" to "Love's Labour Lost to Cymbeline", and I've never read anything that so eloquently conveys the sound thinking in a most serious situation crying for illumination.

Thank you for writing such an article.

Thomas A. Ward Jr, President
(ATR #7254)

Bank of Craig,
Craig, Mo.

This note is to thank you and congratulate you for your fine articles in Flying. There is no doubt that you are encouraging and inspiring many readers . . . in presenting the national picture to the public.

I agree with you wholeheartedly that "organization . . . prematurely is poor strategy", and that individual articulation is our most effective force.

America still has the quality that enabled it to overcome all obstacles. . . . That quality must be stronger than anything in the world today.

Ruth A. Christensen

Hollywood, Calif.

I would like to thank you for your extremely well put editorials. . . . I especially liked the July editorial "Briefing Time". The indifference of people around here is quite disconcerting.

Keep up the good work.

W. H. Harris

Clayton, N.M.

COST OF FLYING

. . . . A letter of appreciation and comment is long overdue for such a fine magazine that has been coming to me for quite a few years.

Words fail me when I try to describe the thrill and feeling of flight, but Gill Robb Wilson has done it so many times in his articles and The Airman's World. Also appreciate his challenging editorials. I know he has spoken for many of us.

I follow with interest the items decrying the high cost of flight time and instruction. But the old saying "where there is a will, there is a way" still holds true. These costs have not increased as much as wages and salaries have, at least in our locality. In 1943 I could buy time in a J-3 for $7 per hour solo. Until recently when the plane was sold I could rent a Champ for $8. Meanwhile wages have doubled plus.

(Continued on page 7)

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MAILBOX

(Continued from page 4)

What really increases the cost of flight time is the more expensive and better equipment we fly today. In 1943 I flew a $2,000 two-place plane for $7 per hour. Now I fly a $10,000 four-place, fully equipped plane with a 50 per cent increase in cruise for $15 per hour. Why should I grumble and growl and fuss? I'm glad I live in a land where I can fly as I do and experience the awesomeness of flight.

ARTHUR L. YODER

Reedsville, Pa.

TRIBUTE TO TUCSON

In today's aviation world special considerations to the private pilot by fixed base operators is still enough of a rarity to receive special mention in magazines such as FLYING. It is much more of a rarity to find the municipal government of a large city attempting to do this.

For this reason I believe tribute should be paid to the Tucson Airport Authority for its establishment of the RONTEL and the services to the private pilot which are connected with it. These include: transportation to any point on Tucson Municipal Airport; motel right on the field—with air conditioning and TV at no extra charge, free tiedown of your aircraft at the front door of your room, 24-hour gas service, a dining room across the street from your tiedown—it opens at 5 a.m. which any pilot can appreciate when attempting to get an early start to avoid the desert heat; and, finally, and certainly most unique a friendly staff who act as though it is their personal responsibility to make you glad you stopped there.

With regard to this last item, it might be well to remember that employes of governments, whether municipal, state or federal, are not notorious for their personal treatment of the public. It is therefore most refreshing to find a governmental organization where individuals, from the manager down to gas attendants, take a pride in their work and appear to foster the cause of aviation generally by doing an outstanding job in their locality specifically.

Hats off to Tucson Airport Authority and to you private pilots who pass that way . . . I'm sure you'll receive the same fine treatment I did.

ARNOLD A. GRIESE

College, Alaska

NAVY WF-2s

. . . Perhaps your readers wondered what type aircraft was featured as the test model in the photograph on page 43 of your July issue, accompanying the article "Lightning Strikes" by Mr. Viemeister.

It is a familiar sight to San Diegans, personnel of USN Air Station North Island, and most of all to pilots of VAW-11 who fly it. The plane? The Grumman WF-2 "Tracer" employed in both carrier and shore-based early warning nets.

Your magazine is familiar to us, let this be an introduction to our squadron's aircraft.

LT. (J.G.) THOMAS C. NELSON, USNR

San Diego, Calif.

TIMBER PILOTS

I have just finished reading a book entitled "Tall Timber Pilots" by Dale White and Larry Florek. Then, much to my surprise and pleasure as I was reviewing the June issue of FLYING I came upon the wonderful article "You Can Do a Lot with a Good Airplane", by R. F. and D. S. Stockstad. This confirmed all that I was in doubt about.

Robert Johnson (head of Johnson Flying Service, subject of the article—ED) must be a remarkable man and I can only say flying is what it is today through people like him who blazed the trail through the early years of general aviation.

Thank you for such a fine magazine and article.

GEORGE W. WINANS

Springfield, Mo.

AIRPLANE KEY TAGS

This might go for a "What's New" item. . . . At any rate it is something I have found most convenient.

Many of us get the little miniature car tags made by the Disabled Veterans in Cincinnati, O. After searching for a misplaced airplane key on the keyboard at a fixed base operation one morning and then picking up the wrong set, I have solved the problem.

Ask the Disabled American Veterans for your aircraft number on one of the miniature tags. (They request you to return whatever change you will, and they send two tags.) This key gives you your aircraft number, state, and a postage guaranteed return.

Nice for boats, too.

BETTY W. MCNABB

Albany, Ga.

SABRES OVER BRANDYWINE

Dave McCallister was the kind of a guy who would understand an editorial error. And we made one in reviewing his book *Sabres Over Brandywine* (October, HAVE YOU READ?). Dave was in the Delaware Air National Guard, not the Maryland Air Guard.

JAMES F. SUNDERMAN, Book Editor.

SEAPLANE FLYING

We operate a seaplane base in California, and would like to take this opportunity to compliment you on the publication of Mr. Larose's article "The Sport of Seaplane Flying" in your August issue. . . .

Many of our students and friends have called our attention to the article; in fact, there has been so much comment about that we would like to obtain reprints for distribution to the many pilots and aviation enthusiasts in our area who may not have seen it in the magazine. . . .

D. J. SEID

Seid Aviation Corp.,
Sausalito, Calif.

PA-18 THIRD SEAT CONVERSION

I am writing to let you know of the success of the item you ran in the New Products section of your July issue about my third seat conversions for the Piper PA-18.

I received about 25 letters from interested parties, including one from Nairobi, Kenya, and have sold 10 kits to date all over the lower 48 states and Canada. . . .

RODGER BORER

Spenard, Alaska

BRIEFINGS...

First Crossing of the Continent in a sailplane is the unprecedented feat of Robert Fisher of Moses Lake, Wash. Fisher, 46, flying a Schweizer 1-23H, took off from Seattle on June 30 and landed at Zahn's

Airport, Amityville, N.Y. 59 days, 29 air hops and 2,800 miles later. He was towed aloft by a Piper PA-18, piloted by David Hensel, 27, Eucumckaw, Wash., for each of its hops. The shortest was 25 miles; the longest and highest, a 345-mile glide over the Rocky Mountains at 16,200 feet. On behalf of the Soaring Society of America and Long Island Soaring Association, Alex Dawydoff, SSA regional governor and managing editor of FLYING presented a scroll to Fisher in recognition of the flight.

Varig Airlines of Brazil has completed negotiations for the acquisition of Real Airlines, South America's largest airline with a total operating mileage of 70,000 miles, at an undisclosed price. Acquisition of Real brings Varig's total route mileage up to 102,000 miles and fifth in rank among the world airlines. Three Convair 990 jet transports, slated for delivery to Real in December, are included in the transaction and will be used by Varig for the Miami and Los Angeles-Tokyo routes.

Export of 874 civil utility aircraft valued at $16,694,100, by four U.S. manufacturers during first six months of 1961, represents an increase of 23 per cent in dollar value and a 13 per cent gain in unit numbers for the same period in 1960, according to a survey made by the AIA. Shipments were made to 65 different nations, the leading nations being: Argentina, 100 aircraft; Canada, 124; West Germany, 29; Great Britain, 68 and Brazil, 64.

Jacqueline Cochran hit the jackpot in recent series of world record speed busting trials in a Northrop T-38 Talon supersonic trainer and now holds every women's speed record in the world. August 24 last, Jackie captured the 15 kilometer record, held since 1955 by Mme Jacqueline Auriol of France, at 844.2 mph. A week later, she toppled her own 500 km (310.69 miles) record of 1953 with 659.6 mph, then upped this on Sept. 7 to 680.855. This she followed (Sept. 8) with the 1,000 km distance

record of 640.392 mph to upset France's Elizabeth Boselli's 463.670 set in 1955 in a Mistral jet; Sept. 15, with a closed course distance mark of 1,492.394 statute miles, also held by Miss Boselli; and, Sept. 18, with a straight line distance record of 1,492.394 statute miles. At press time, Miss Cochran was still going for more.

History repeated itself 50 years after the U.S. Navy flew its first aircraft—a Curtiss A-1 "Triad," purchased at the cost of $5,500—when this replica of the original appeared over San Diego, Calif. in an air show marking the 50th Anniversary of

Naval Aviation. One of two replicas constructed by volunteers, the materials were all donated and the project required over a year to complete. The second replica, a nonflyable machine, is going to the Smithsonian Institution.

Flight Test Guide for those preparing for an instrument ticket has been published by FAA. Available from the Government Printing Office, Washington for 15 cents, the eight-page booklet describes oral, instrument flying and radio navigation and approach procedures included in the test.

Private airborne transportation for the vice president of the United States, L. B. Johnson, is a Lockheed Lodestar. Fellow-Texans Horton-Horton of Meacham Field, Ft. Worth, executed the custom-designed executive interior reflecting his official position. Houston-born Edwin Raphael of the Edwin Raphael Co., Holland, Mich.,

created the draperies, coming up with a celestial design that features large stars (for the Lone Star State) with each star cradling the letter J., co-featured with a scripted letter J inside a propeller-like sign. The color scheme is brown, orange, and beige.

Twenty French-built Caravelle jet transports, powered by American-made General Electric CJ805-23C aft-fan jet engines, will join Trans World Airlines' fleet beginning January, 1963. The purchase, representing nearly $100 million including spare engines and parts, was negotiated through Douglas Aircraft, U.S. sales-service representative for the Sud Aviation Co. of Toulouse, France. TWA's "La Nouvelle Caravelle"—latest Model 10A—incorporates many aerodynamic improvements which give the plane greater speed and range. The order includes an option for 15 additional aircraft of the same type.

To encourage pilots to attain at least minimum instrument skill, the FAA is now giv-

(Continued on page 162)

DEDICATION—Over 60 private airplanes flew into the White Mountain Airport at North Conway, N.H. for recent dedication of a new 3,000-foot runway. And with the airplanes came such aviation leaders as William T. Piper Sr., president of Piper Aircraft; and State Aeronautics Director Russell Hilliard. Serving one of New England's most popular year-round resort areas, the airport is owned and operated by Wylie Apte and his ex-USAF son, Wylie Jr., a father-son team of true Yankee enterprise and dedication to general aviation.

NOTAM...

NOTAM. ADVISE COMPANY PILOTS BEGINNING 1962 AERO COMMANDER JET 1121 WILL TAKEOFF 3000' RWYS, CRUISE 500 MPH OVER WX AT 35,000' FOR 1500 MILES. NEW EXECUTIVE JET IS MID-WING, SIX PASSENGER TWIN. AFT-MOUNTED ENGINES, GENERAL ELECTRIC CJ610-1'S, HAVE HIGHEST THRUST/WEIGHT RATIO. TURBOJETS PRODUCE 2850 LBS THRUST, WEIGH ONLY 355 LBS, ONLY 40" LONG. CJ610 MILITARY COUNTERPART -J85- POWERS USAF SUPERSONIC TRAINER. RELIABLE NEW JET POWER FOR BUSINESS AIRCRAFT IS LATEST PROPULSION PROGRESS FROM GENERAL ELECTRIC, WORLD'S MOST EXPERIENCED MANUFACTURER OF JET ENGINES.

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18-F-111

MAIL THIS COUPON TODAY

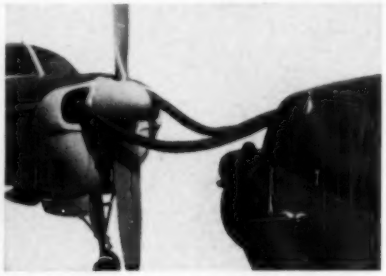
For other courses, see pages 4, 80 & 106

NEW PRODUCTS

Lightplane air-driven gyros and pneumatic autopilots now can be checked on the ground, without starting the engine, with the Vacuum Instrument Text Kit just introduced by Airborne Mechanisms, 13229 Shaw Ave., East Cleveland, Ohio. The unit holds constant vacuum levels from zero to

10 inches of mercury. Portable and self-contained, it weighs 40 pounds. A one-half-hp 115-V electric motor drives a vacuum pump at predetermined speed; thus actual engine operating conditions are simulated during ground testing of the aircraft.

An aircraft engine preheater that can be used with any aircraft having flat opposed engines and two inlet eyes is being offered by The Vistair Co., 585 W. Riley Rd., Owosso, Mich. Called the "Heat-Porter", the unit adapts into any standard size car



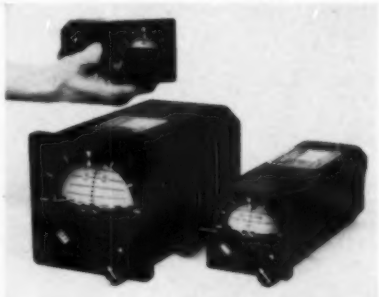
window and plugs into the 12-volt cigarette lighter receptical. The "Heat-Porter" weighs less than 11 pounds and comes in handy carrying case at $49.95.

Combination inflatable boat/life raft has been developed and is now in production at Air Cruisers Division, Belmar, N.J., a division of The Garrett Corp. To assure extreme seaworthiness, the boats are made with double the buoyance required for maximum capacities; include two separate buoyancy chambers. A two to four-man craft and a six to eight capacity craft are immediately available. Equipment on board includes life lines, aluminum oars, a rowing seat, hand inflation pumps and CO-2 automatic inflation system.

Aircraft battery charger designed to perform this operation correctly, and without overcharge or damage to the battery, is a new offering of Aircraft Components, Inc. of Benton Harbor, Mich. The new charger is rated to put out four amperes at 12 volts or three amperes at 24 volts. In addition it has a low output setting for trickle charging and long time storage. Input is 110 volts AC. It sells for $22.50, complete.

Super-Nav I Omni converter introduced recently from Long Beach, Calif., by Skycrafters, Inc., is a standard 3¼ inch panel-mounted unit weighing less than two pounds. It features a horizontal meter which protrudes slightly for ease in reading from any angle and large diameter course selector numbered at 15-degree intervals for rapid identification. Its resolver type course selector is rotated by a vernier drive. A to-from Switch eliminates the need for a separate to-from meter. For further details see Navcom article elsewhere in this issue.

Miniaturized two-inch vertical standby gyro indicator, designed to guide aircraft to destination should the primary remote indication system fail, is in production at Guidance Technology, Inc., (previously Summers Gyroscope) at Santa Monica, Calif. Named "Vigil", the tiny two-pound,



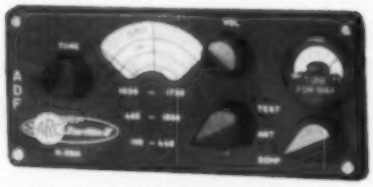
self-contained instrument (held in hand) is compared here with the larger 14-pound remote indication system it replaces. Its small size also makes the instrument suitable as a primary vertical gyro indicator for aircraft not ordinarily fitted with remote indicators, the manufacturer states.

Three-piece chrome-plated aviation spark plug torque wrench set has been designed for aviation mechanics by Champion Spark Plug Co. of Toledo, Ohio. This set features a flex-handle, permitting 30-degree handle travel in either direction; Cham-

pion's exclusive torque limiter, controlling applied torque to 28 foot-pounds, for snug plug fit; and magnetic socket, which holds plugs securely, yet does not magnetize them. The set is labeled CT 418.

NEW *for lighter, smaller aircraft*

IN-501A INDICATOR. Luminous dial, large easy-to-read characters



R-501A RECEIVER. Panel-mounted, highly sensitive, light weight

A Compact, Highly Sensitive Local Control ADF System

In its new 501A ADF System, ARC presents a whole new dimension in performance and economy for compact aircraft. Offering service and dependability that more than meet your flying requirements, it is light in weight, low in cost, simple and easy to install.

COMPACT DESIGN SAVES SPACE, REDUCES WEIGHT

ARC's new 501A System is designed to operate from the primary aircraft power supply. No separate power unit or rotating machinery is required. Current drain is reduced, efficiency is improved. Valuable space is saved, and weight reduced.

The heart of the system is its highly sensitive, panel-mounted, complete receiver, which includes the tuning meter. The large indicator dial covers a full 360°, providing greater tuning ease and readability. Using both transistors and vacuum tubes for optimum efficiency over wide temperature ranges, the 501A's receiver will operate dependably in the most severe environmental conditions which may be encountered in the aircraft's cabin.

The entire 501A System, excluding cables, weighs 14.2 pounds, with its slim, electrically compensated loop, low-weight amplifier unit, and luminous easy-to-read indicator.

EASY TO INSTALL

Multi-color coded cables simplify and speed installation. An installation kit provides everything you need. There are no complicated drawings or numbers to puzzle you.

For the budget minded aircraft owner, who insists on quality and performance, there is no better ADF System than ARC's 501A!

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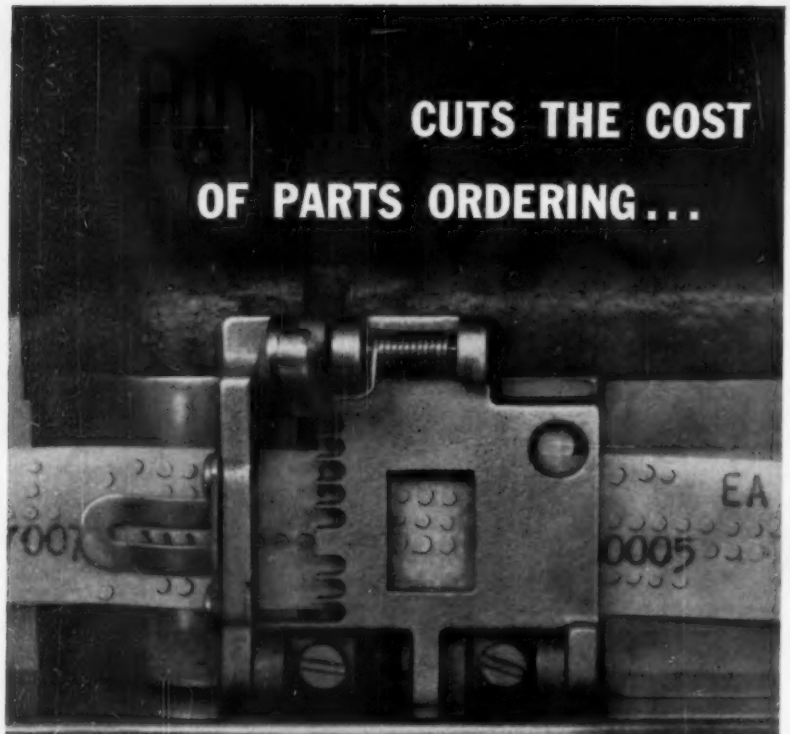

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WHO and WHERE

Neil P. Whitney has succeeded William F. Sauers, resigned, as president of Aircraft Radio Corp., wholly owned subsidiary of Cessna Aircraft at Boonton, N.J. Whitney is former general manager of Cessna's industrial products division at Hutchinson, Kan. ARC has also promoted Richard F. Post to head its military and industrial products departments, and named Al Holmes, of Toledo, Ohio systems engineer.

Harvey Ewing, former South Central regional manager for Beech Aircraft, has joined the J. R. Gray Co., Beechcraft distributor for 56 counties in North Texas, as president and general sales manager at Dallas.

Robert T. Van Sant has been appointed vice president of the Wilcox Electric Company's commercial marketing division, Kansas City, Mo. Clarence Lee Wolfe has been named vice president of the company's military marketing division.

Leonard J. Kash, former Northwest regional sales manager for Cessna Aircraft Co., has joined Airflite, Inc., Cessna distributor in Long Beach, Calif., as assistant to vice president and general manager Vern Etter.

Robert C. Wormald has succeeded J. R. Muehlberg as manager of aviation sales of Esso Standard, Eastern Region, Humble Oil & Refining Co. Muehlberg recently was named coordinator of aviation sales at Humble headquarters, Houston, Tex. Wormald remains at Esso Standard's New York City headquarters. Robert O. Goodykoontz, general manager of Humble's Central Region, has been named vice president in charge of Esso Standard, Eastern Region, New York, effective January 1.

Charles E. Young is named district sales manager for Lear, Inc.'s Instrument Division at Fort Worth, Tex. Young replaces P. R. Carlton, who has been promoted to Northeast regional manager with headquarters in Stamford, Conn. J. E. Card has been upped from assistant manager to manager of Lear's Central Region at Dayton, Ohio.

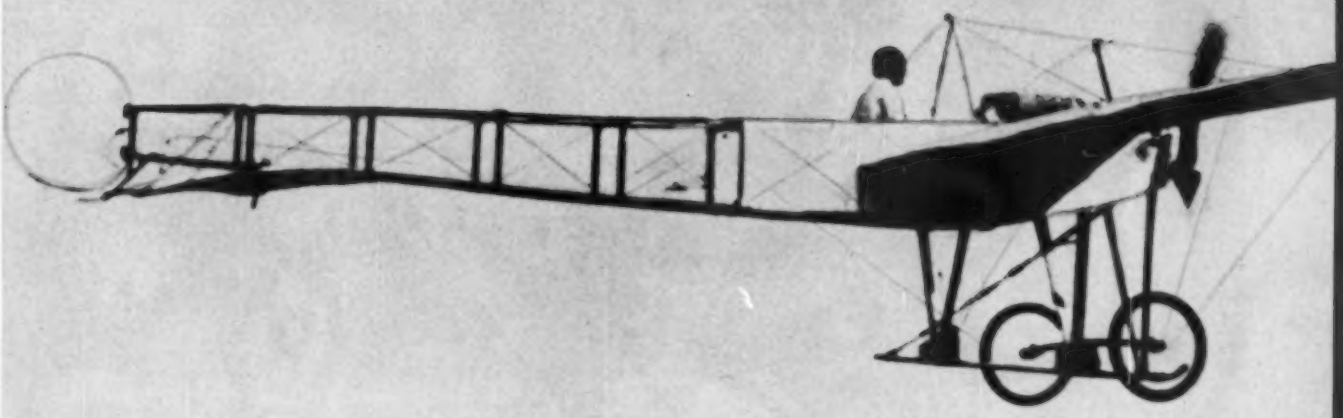
Bernard L. (Benny) Whalen of Fairfield, Conn., who earned his pilot's license at Orville and Wilbur Wright's flying school in 1913, has been elected president of the Early Birds. Now retired, Whalen was formerly general manager of Sikorsky Aircraft and a vice president of United Aircraft Corporation.

Martin Decker is elected president of NAA, as Jacqueline Cochran moves up to Chairman of the Board. Roger C. Fleming is the new senior vice president.

Howard L. Hartman, Air Carrier Service Corp., is transferred from New York City to Washington, D.C., to succeed E. L. Lynn (reassigned to other duties) as director, special projects. W. J. Stewart will handle Aero Commander export sales in the Washington office.

1912

Clyde Cessna
flew his Silver Wings
at 50 mph and
began 50 years
of progress in
business aviation



young mechanic, Clyde Cessna, saw his first air show in 1910. Fired with enthusiasm, he returned home, built his first airplane, and taught himself to fly. But after flying the new ship in several shows, he was dissatisfied and completely rebuilt it. By 1912, he was amazing crowds with the 50 mph speed of his Silver Wings—and began the tradition of constant design advancement which has made the Cessna Aircraft Company the world's leading producer of business aircraft.

CLYDE'S COMET, third of 15 planes he had built by 1925, was his first with an enclosed cockpit. In 1927, he officially formed the Cessna Aircraft Company, and by 1929 it owned 5 buildings and 80 acres at the present Pawnee plant site in Wichita, Kansas.

A LANKY NEPHEW, Dwane Wallace, joined the company in 1934 as chief engineer. And when he wasn't busy bringing home purses from air races to meet the payroll, he helped design the famous *Airmaster.*

THE AIRMASTER won the National Award in 1935. In 1936, Clyde Cessna retired and Wallace, as the new president, flew the Airmaster to victory again. Prize: permanent possession of the trophy and the title, *"World's Most Efficient Airplane."*

GIANT STEPS FORWARD: In 1939, Cessna launched the twin-engine Bobcat, of which over 6,000 were produced as military trainers. In 1946 (the war over), Cessna again turned to private aircraft and sold nearly 4,000 planes. And, as new needs arose, new models were designed. For example:

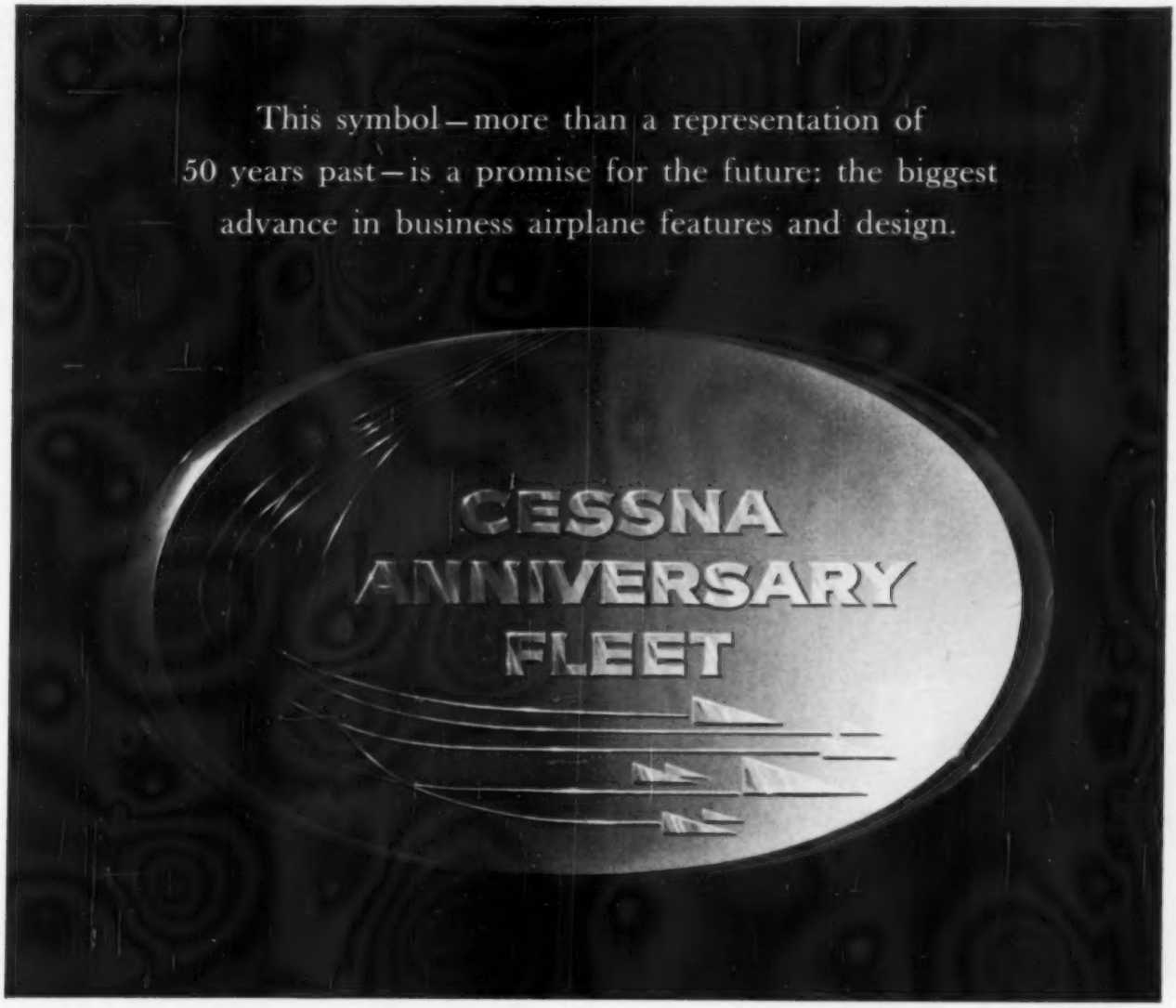
THE CESSNA 310 was introduced in 1954 and became an immediate success by filling the demand for a high-performance executive twin. By 1957, Cessna completed its 30,000th plane and was producing everything from a line of 6 business aircraft to bomber components, jet trainers, and helicopters for the military.

IN 1960, the Cessna 210 was introduced. With its combination of retractable landing gear and high wing, it promised twin-engine speed with single-engine economy and flying simplicity to business flyers, and that year became the world's second-best seller—beat only by the all-time favorite *Cessna 172.* Competitors felt Cessna's tremendous bite of the market—over 50% of the Big Four Manufacturers' sales—and acknowledged the company had certainly arrived.

TODAY, Cessna enjoys the reputation of being not only the oldest business plane manufacturer, but also the most successful. The company's modern facilities extend over 1,200 acres at Wichita and it owns three subsidiary companies. It markets its products through over 400 dealers around the world. And it produces thirteen of the world's most popular business aircraft.

NOW FOR 1962:

To put all 50 years of aviation design experience into a line of airplanes that will remain advanced many years to come—Cessna *doubled* the money usually spent for design advancement and retooling. And, so successful were the results that Cessna *doubled* the warranty life on its entire Anniversary Fleet. For these reasons—


This symbol—more than a representation of
50 years past—is a promise for the future: the biggest
advance in business airplane features and design.
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ANNIVERSARY
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FIRST PUBLIC SHOWING—NOVEMBER 4TH AND 5TH—*Preview the first of Cessna's new Anniversary Fleet at your nearby Cessna dealer's. (While you're there, ask your dealer for dates all 13 models will be shown.)*

Thirteen business aircraft

CESSNA

"Build every engine as if you're going to fly it yourself..."

A behind-scenes report on **LYCOMING** *. . . one of the great names in aviation history*

Examining cutaway of Champion's new *Foul-Resistant* spark plug—Herb Fisher and Floyd J. Bird, Vice President-General Manager, Lycoming division of Avco.

by HERB FISHER

international aviation authority, veteran test pilot, author

"Custom-built." "Precision-balanced." "Individually handmade."

These are not static words with the Lycoming division of Avco Corporation. These are the dynamics of Lycoming engine production. And every man who's ever flown behind a Lycoming engine can appreciate the worth of these words . . .

I doubt if there are very many people connected with aviation who *haven't* been behind a Lycoming engine. Two out of every three twin-engine utility aircraft produced in the United States today are powered by Lycomings. Over half the entire light utility fleet is powered by Lycomings. More than 75 *different* models of aircraft and helicopters are powered by Lycomings. They operate in every corner of the globe—under every operational extreme known. As a helicopter engine manufacturer, Lycoming is by far the world's largest.

Lycoming began in 1908 in Williamsport, Pa., and soon was producing engines for virtually all the famous automobile and truck manufacturers of the day. Thousands of 4-cylinder Lycomings saw duty in World War I. (Lycoming also made fragmentation bombs and gas shells.) In 1924, Lycoming introduced America's first "straight-8." It became standard equipment for the Auburn. Lycoming made 57 types of motors in the '20s—for all makes of autos. Marine engines followed.

In 1928, Lycoming turned to aviation and produced its still-famous R-680 9-cylinder, 215-hp radial engine—powerplant for civil, military and first scheduled airlines aircraft. Production of this engine ran 20 years! A long line of more advanced engines followed . . . and Lycoming achieved aviation immortality with many historic "firsts." Thousands of Lycoming aircraft and tank engines powered Allied troops in

R. T. Vandergrift, Lycoming Service Manager (far right), takes Fisher through Lycoming's Engine Service Center at Williamsport Airport. From here, experimental engines are flight-tested and customers' engines are serviced (along with those of Lycoming's own fleet—Piper, Beech and Aero-Commander aircraft).

Lycoming engine undergoes grueling 150-hour heavy-load dynamometer test. Here, Champion spark plugs are evaluated with other brands under torturous conditions. L/R—Fisher; C. H. Wiegman, Vice Pres.-Engineering; Tom Allegretti, Champion Representative; C. H. Buddenbaum, Vice Pres.-Manufacturing; Kenneth Burns, Test Cell Operator.

World War II. Today they power record breakers like Max Conrad and Jerrie Cobb to aviation's Hall of Fame.

In this past year, Lycoming has introduced a complete line of fuel-injection engines. And, even more recently, the turbo-supercharger engine. (First production model has been delivered to Bell Helicopter.) At this writing, Lycoming's crack engineers are in advanced development of a revolutionary 8-cylinder engine.

A half-century of recognition for superb engineering and high-precision production *quality* has made Lycoming a natural for missile work, too: Prime contract (Avco) for Titan and Minuteman re-entry vehicle design/development. Nose cones for the Nike-Hercules. Diffusers for Talos. Production of rocket chambers for both Polaris and Minuteman.

Behind every Lycoming engine is an admonition for self-discipline that the people at Lycoming take very seriously: "Build every engine as if you're going to fly it yourself." It's this self-discipline —backed by a rigid system of quality controls—that puts the guts into Lycoming's program of custom-built, precision-balanced engines.

A quartet of hard-core realists—Floyd J. Bird, Vice President and General Manager; C. H. Wiegman, Vice President-Engineering; C. H. Buddenbaum, Vice President-Manufacturing; and John M. Ferris, Vice President-Sales—took me through the Lycoming plant at Williamsport. Here, some 2,000 people manufacture 4- and 6-cylinder utility aircraft engines. (Jet turbine engines and missile components are manufactured at the company's Stratford, Conn., plant.)

Production at Williamsport starts with milling casting. Eighteen different engine models (or 50 types) take shape in *straight-line assembly*—one integrated production line, unique in this business. Top technicians "hand pamper" components and engines with high-precision machinery at individual "stations" along the integrated straight-line. The best in materials and individual craftsmanship goes into each engine—right down to the chrome-plating of cylinders, another unique feature. A rigid system of controls in production, inspection and testing enables the company to guarantee perfection of each customized engine leaving its plant.

Engines are periodically "torture-tested." Dynamometers load them to capacity and tax their components to the utmost—simulating flying conditions more grueling than a pilot will ever encounter. Performance of components is evaluated and findings of the 150-hour qualification tests are reviewed with the FAA.

In these test cells, Lycoming "weeds the men from the boys" in the way of engine components. It is here that close attention is given one of the most vital of all engine components—the *spark plug*, heart and life beat of an engine. Here Champion spark plugs are evaluated with other brands.

After Champion Engineering developed the new *Foul-Resistant* spark plug, for example, Lycoming put them to the dynamometer torture-test for competitive evaluation.

Results *confirmed* the foul-free performance and long-life dependability of the new *Foul-Resistant* plugs, and Lycoming placed large orders for them. (Five thousand Champion REM40E's came in while I was visiting the plant.)

This, then, is Lycoming—custom-builder of aircraft engines of the highest quality. As a long-time test pilot, I have a deep personal appreciation of the engineering and precision craftsmanship that goes into every single Lycoming engine.

CHAMPION SPARK PLUG COMPANY • TOLEDO 1, OHIO

Above: Wiegman, Fisher and Allegretti inspect engines in unique "Straight-line" assembly. At left: They examine finished engine headed for dynamometer test.

First station on engine buildup: Every 6-cylinder Lycoming engine begins here with this one master craftsman—Paul Horner. He averages one an hour.

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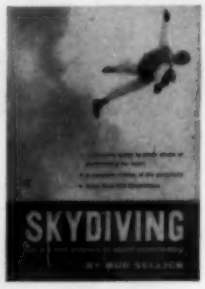
HAVE YOU READ?

By JAMES F. SUNDERMAN

SKYDIVING: THE ART AND SCIENCE OF SPORT PARACHUTING, by Bud Sellick (Prentice Hall, Englewood Cliffs, New Jersey, $5.95).



While the art of sport parachuting goes back to the pioneer days of flight and is now a common European pursuit, it was introduced to the United States about five years ago. Author Sellick, 29-year-old President of the Tennessee Skydiver Club, writes a thorough account of this exhilarating avocation which is drawing increasing numbers into the exclusive fraternity.

The book is a guide and a history, a comprehensive fact-packed illustrated narrative which will benefit all who at one time or another slip into a chute for sport or safety.

Rules and regulations, says Sellick, make this sport as safe as fishing, hunting, and boating; and there are fewer skydiver fatalities each year than in the more common sport activities.

For those who are curious, or wish to learn, or hold a misunderstanding of this sport, Sellick's book is highly recommended.

CIVIL AIR REGULATIONS AND FLIGHT STANDARDS FOR PILOTS, 23rd edition (Aero Publishers, 2162 Sunset Blvd., Los Angeles 26, Calif., hard cover $4.50; paper cover $3).

This familiar annual edition enables pilots to keep current with government flying regulations and the various types of flight operational procedures. For the student, amateur and professional pilot, it is a standard guide and instructional manual in question-and-answer format.

THE WORLD FAMOUS RACING AIRCRAFT (Floyd Clymer, 1955, $1.50).

These three volumes, while not new, are still available for the aviation buff and historian. The first presents a complete historical narrative with attractive black and white and color art of famous American planes and the races in which they took part—beginning with the first International Air Meet at Rheims, France, 1909, to 1951 National Air Races at Detroit, Michigan. The men, the machines and the race statistics are presented in narrative and tables.

The second, especially attractive to model builders, is a year-by-year guidebook with three-view drawings, capsule accounts and boxed-in race statistics.

The third comprises photos and line-drawings of 72 speed planes and a tabulation of official speed records and race winners.

AVIATION AND SPACE DICTIONARY, edited by Ernest J. Gentle and Charles E. Chapel (Aero Publishers, 2162 Sunset Blvd., Los Angeles 26, Calif., $10.00).

A newly revised 4th edition contains definitions of more than 10,000 aerospace terms, complemented by 200 illustrations, and useful tables and charts. Since its first publication in 1939, it has been a standard desk reference.

With the addition of missile and space terminology it serves a continuing usefulness for the air community.

THE SEVEN SKIES: A STUDY OF B.O.A.C. AND ITS FORERUNNERS SINCE 1919, by John Pudney (Putnam, London, distributed by Morgan Aviation Books, Dallas 34, Texas, $4.95).

The British penchant for detail and thoroughness is the hallmark for this history which signals the 40th Anniversary of civil aviation in England.

It was on August 25, 1919, that the first scheduled international air service began between London and Paris, using a wartime DH-4 converted to passenger accommodation. Other civil transports were the flimsy twin-engine Handley Page biplane bombers, also converted to passenger use. The pioneers of this first air transport flight were pilot Bill Lawford (died in 1955) and passenger George Stevenson-Reece, a reporter whose account (telephoned to London upon landing at Le Bourget) made history in the *Evening Standard*.

From this humble beginning Imperial Airways flew 853,000 miles its first full year of operation.

By 1938, its last full year of peacetime flying, it covered some six and a half million miles.

Author Pudney traces the evolution of British private air enterprise through the formation of various companies—into Imperial Airways, the building of British Airways and their eventual merger in 1940 into B.O.A.C.

It is a history of the men, the aircraft, the pioneering routes as they spider-webbed around the globe and are flown today by the Comet jets.

NATIONAL AIR RACE SKETCHBOOK, by Fred W. Buehl and Harry S. Gann (Floyd Clymer, 1268 S. Alvarado St., Los Angeles 6, Calif., 1949, $2.00).

If you have trouble securing books reviewed here, send payment in check or money order to AEROSPACE BOOK CLUB, 7801 Old Georgetown Road, Washington 14, D.C. Your books will be sent postpaid.

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COLLINS

General Aviation in Perspective

GILL ROBB WILSON
Publisher

AS A SINEW of national strength, I would not exchange our general aviation for Russia's technological triumphs in space.

Moreover, those triumphs will be duplicated in due course as the broader base of aerospace science in the free world advances toward its apex.

Conversely, no socialist state can duplicate the stature of general aviation in the United States and remain a police state, since basically general aviation examples government and people sharing the freedom of national skies.

In the evolution of flight, the sky has become so fundamental that socialist regimes find it necessary to segregate their peoples aground. This is the direct antithesis of general aviation which finds the citizen pursuing his own ends aloft for profit or pleasure in relative compatibility with national requirements.

It seems well to keep this matter in perspective on several counts—first, that as citizens we draw pride and inspiration from the sensitivity of our government to private opportunity and second that such opportunity serves our competitive lives so richly.

We would be undeserving if we did not mark that government has created a climate in which general aviation could thrive. True indeed, this condition has not been preserved without vigilance, but what freedom has ever existed unearned? The slave is always the author of his own bondage. Masters merely fix the price.

Another reflection on general aviation notes it as a yardstick of the dynamic in American life.

The business plane, the agricultural plane, the family plane—these are radically new and unusual vehicles which have had to gain favor in competition with the varied vehicles of land and water and against the ageless pull of earthbound habits.

A lively spirit of exploration in business and industry was essential to so much as give the executive aircraft a chance in corporate affairs. The farmer required something more than a strong back to envision the plane as an agricultural implement. The private pilot needed unusual initiative to choose the high road for his venturing. The manufacturers of general aircraft had to muster exceptional vision as prelude to the production line.

So, it adds up that general aviation rests on a foundation of quenchless initiative in a climate fostered by free government. So long as this condition prevails its potential is limitless.

Relative to this destiny, is the ever urgent development of airport facilities. A chain is no stronger than its weak links.

Across the country is a magnificent network of airports publicly funded by federal, state and municipal government. However they are inadequate to the potential of general aviation.

In an effort to supplement them and bring service to lesser local communities lie hundreds of struggling small private airports—weak links now, but potentially strong links tomorrow.

Might not our Federal Aviation Agency bring these acorns of airpower under study with a view of helping them mature, not by public funding, but by loan of equipment to enhance their immediate stature—runway lighting, beacons, weather service communications, jeep service trucks, light grading or maintenance tools, or whatever might be most constructive and feasible.

Many of them would make the grade to stabilization as private enterprises or official community projects with just a little help and encouragement. If such loans of equipment are not feasible, perhaps long range amortising rentals would serve. In any case there is national purpose to be served in strengthening the little airports and others would doubtless spring up as a consequence.

As for precedent—is not the whole of general aviation a case in point—partnership of government and people to a common end, united in strength and dedicated to freedom. If we are first in this we shall not be second in destiny.

At American Airlines we do an awful lot of repeat business

American is usually the choice of people who fly a lot. And it isn't just because of our pretty stewardesses and delicious meals.

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American's great new Astrojet* (the first plane with fan-jet engines) cruises faster than conventional jets, yet doesn't need endless runway space. Its reserve power makes on-time arrivals more certain.

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American's pilots have flown more passengers than any other group of pilots in the world. Many are 7-million-mile men.

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* SERVICE MARK OF AMERICAN AIRLINES, INC.

AMERICAN AMERICA'S LEADING AIRLINE

General aviation plans for the future. A comprehensive report on new developments as well as upcoming models

FIXED-WING AIRCRAFT

By FLYING STAFF

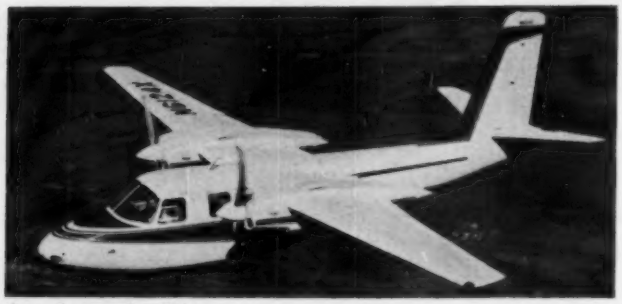
Long-range potential of general aviation aircraft—sparking the continued growth of what is now the biggest industry in the country—is tied to the increasing effectiveness and use of the airplane as an essential tool of business and industry, as well as personal use.

Advanced design features and developments—highlighted in this special FLYING report—combine with new powerplants, communications and support equipment in making available added factors of safety, utility, comfort, all of which are coupled to fast air transportation in a variety of aircraft tailored to a variety of needs.

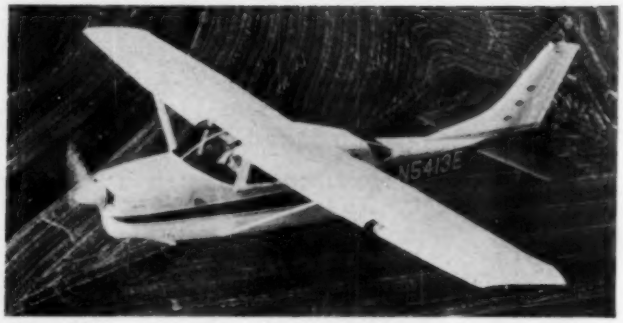
Today's general aviation fleet runs to all types of civil flying except airline transport. And the light aircraft are expected soon to invade the transport category as "third level" carriers, utilized to feed passengers on a scheduled basis into cities served by the larger local-service and main trunk lines.

Active today are almost 77,000 aircraft (as against 2,000-plus flying with the airlines). Of these, over 7,000 are multiengine and roughly half of the remaining single-engine aircraft are four-place and over.

The FAA predicts a continual climb towards its 1965 estimate of 90,000 general aviation aircraft (10,000 of these multiengine) and the 1970 estimate of 105,000, which would include 14,000 multiengine airplanes and



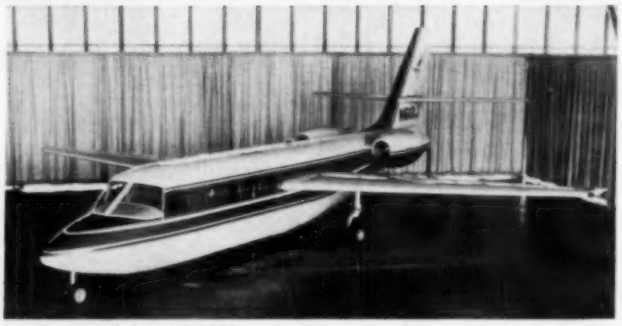
Aero Commander 680F



Cessna 210

Grumman Gulfstream

Cessna Skymaster



Jet Commander Model 1121

PERSONAL & BUSINESS FIXED WING AIRCRAFT

Manufacturer	Aircraft designation and Model No.	Number of Seats	Span (feet-inches)	Length (feet-inches)	Height (feet-inches)	Wing Area (sq. ft.)	Weight empty (lbs.)	Maximum gross weight (lbs.)	Powerplant (number, make, model, rating)	Cruising speed (mph)	Maximum speed (mph)	Take-off (over 50 ft.)	Landing (over 50 ft.)	Fuel capacity (gallons)	Maximum range (miles)	Service ceiling (feet)	Basic price ($)
Aerocar, Inc. Longview, Wash.	Model IA Aerocar	2	34	21-6	7-6	190	1,500	2,100	Lyc O-320 143 HP	100	117	1,200	900	24 +14	300 450	12,000	13,990
	IC Aerocar	2	34	21-6	7-6	190	1,500	2,100	Lyc O-360 158 HP	100	121	1,000	900	24 +14	300 450	14,000	14,500
	IIA Aeroplane	4	34	22-9	7-6	190	1,200	2,200	Lyc O-320 143 HP	120	133	1,250	900	24 +14	400 550	14,000	12,500
Aero Commander, Inc. Bethany, Okla.	500A	5-7	49	35-1	14-6	255	4,255	6,250	2 Cont. IO-470-M 260 hp ea.	217	228	1,210	1,150	156	1,800	23,200	67,500
	500B	5-7	49	35-1	14-6	255	4,300	6,750	2 Lyc. IO-540-B1A 290 hp ea.	218	230	1,300	1,155	156	1,305	21,000	81,500
	500F	5-7	49	35-1	14-6	255	4,650	7,500	2 Lyc. IGO-540-B1A 360 hp ea.	232	248	1,350	1,375	223	1,705	21,900	98,500
	680F	5-7	49	35-1	14-6	255	4,800	8,000	2 Lyc. IGSO-540-B1A 380 hp ea.	244	255	1,380	1,330	223	1,310	28,500	113,500
	Jet 1122	6	43-4	48	14-9	303.3	6,800	14,000	2 GE CG610 2,700 lb/t ea.	490	555	1,350	2,219	950	1,900	40,000	475,000
Aircoupe Division of Air Products Co., Inc. Carlsbad, N. M.	Aircoupe F-1A	2	30	20	6	142.6	900	1,450	Cont. C-90-12F	120	147			24	500	15,500	7,450
Beech Aircraft Corp. Wichita, Kan.	Super G18S	7-9	49-8	35-2½	9-8	300.7	5,910	9,700	2 P. & W. R-985 450 hp ea.	214	233	1,980	1,850	318	1,715	23,100	132,300
	Queen Air Model 65	6-8	45-10½	33-4	14-2	277.06	4,660	7,700	2 Lyc. IGSO-480 340 hp ea.	214	239	1,560	1,685	230	1,470	31,300	126,000
	Twin-Bonanza Model J50	6	45-11⅝	31-6½	11-4	277.06	4,460	7,300	2 Lycoming IGSO-480-A1B6 340 hp ea.	223	235	1,450	1,840	230	1,650	29,150	100,000
	Twin-Bonanza Model D50E	6	45-11⅝	31-6½	11-4	277.06	4,100	6,300	2 Lyc. GO-480-G2F6 295 hp ea.	203	214	1,260	1,455	180	1,650	20,300	87,250
	Baron Model 55	4-5	37-10	26-8	9-7	199.2	2,900	4,880	2 Cont. IO-470-L 260 hp ea.	225	236	1,255	1,750	140	1,445	20,000	58,250
	Travel Air Model B95A	4-5	37-10	25-4	9-6	199.2	2,555	4,200	2 Lyc. IO-360-B1A 180 hp ea.	200	210	1,280	1,590	112	1,370	21,160	49,500
	Bonanza Model N35	4	33-5½	25-2	6-6½	181.0	1,855	3,125	Cont. IO-470-N 260 hp	195	205	1,050	840	78	1,410	19,200	26,500
	Debonair Model B33	4	32-10	25-6	8-3	177.6	1,745	3,000	Cont. IO-470-K 225 hp	185	195	1,235	1,282	78	1,135	18,400	21,975
CallAir, Inc. Afton, Wyo.	A-5T	1	35-5	23-10	7-10	186	1,100	2,150	Lyc O-320 A-2A 150 hp	101	116			25	325	17,500	9,500
	A-7T	1	35-5	NA	7-10	186	1,170	2,450	Cont. W-670 240 hp	NA	NA	NA	NA	NA	NA	NA	NA
Cessna Aircraft Co. Wichita, Kan.	150B	2	33-6	21-6	7-10	160	945	1,500	Cont. O-200A, 100 hp	125	127	1,205	1,055	26	610	15,600	7,495
	172C	4	36-2	26-6	8-11	174	1,200	2,250	Cont. O-300-C 145 hp	131	139	1,430	1,140	42	780	14,550	9,895
	Skyhawk	4	36-2	26-6	8-11	174	1,330	2,250	Cont. O-300-D 145 hp	132	140	1,430	1,140	42	780	14,550	11,590
	175C	4	36-2	26-4	8-11	174	1,410	2,450	Cont. GO-300-E 175 hp	142	150	1,205	1,200	52	720	17,800	NA*
	180E	4	36-2	25-6	7-6	174	1,515	2,650	Cont. O-470-R 230 hp	162	170	1,080	1,330	65 (std) 84 (opt)	w/aux 1,215	21,500	NA*
	Skylane	4	36-2	27-4	9	175	1,625	2,800	Cont. O-470-R 230 hp	162	170	1,205	1,350	65 (std) 84 (opt)	w/aux 1,215	18,900	NA*
	185A	6	36-2	25-6	7-7	174	1,520	3,200	Cont. IO-470-F 260 hp	167	176	1,510	1,265	65 (std) 84 (opt)	w/aux 1,235	17,300	NA*
	210B	4	36-7	27-4	9-9	175.5	1,750	3,000	Cont. IO-470-S 260 hp	189	198	1,210	1,110	65 (std) 84 (opt)	w/aux 1,530	20,300	NA*
	310G	5	36-11¼	29-6	9-11¼	175	3,025	4,990	2 Cont. IO-470-D 260 hp	223	240	1,470	1,770	102 (std) 133 (opt)	1,300	21,500	NA*
	Skynight	5	36	29-6	10-4	175	3,190	4,990	2 Cont. TISO-470-B 260 hp	245	265	1,470	1,770	65 (std) 84 (opt)	1,430	27,200	69,950
	Skylark	4	36	26-6	9-6	174	1,420	2,350	Cont. GO-300-C 175 hp	142	149	1,340	1,155	52	760	15,900	14,125
	182E	4	36-2	27-4	9	175	1,545	2,800	Cont. O-470-R 230 hp	159	167	1,205	1,350	102 (std) 133 (opt)	w/aux 1,190	18,900	NA*
Champion Aircraft Corp. Osceola, Wis.	7FC Tri-Traveler	2	35-5	21-8	7-6	165	908	1,500	Cont. C90-12F 95 hp	108	138			26	500	12,000	7,310
	7EC Deluxe Traveler	2	33-5	21-8	7-6	165	929	1,500	Cont. C90-12F 95 hp	112	138			26	500	12,000	6,765
	7GCB Challenger-Deluxe	2	34-4	22	6-8	170.22	1,050	2,325	Lyc. O-320-A 150 hp	125	162	493	580	39	630	17,000	8,650
	7GCB-A Challenger-AG	1	34-4	22	6-8	170.22	1,050	2,325	Lyc. O-320 150 hp	125	162	493	580	39	630	17,000	9,250
	402 Lancer	2	34-5	22-8	7-6	170.22	1,200	2,250	2 Cont. O-200 100 hp ea.	135	165			60	675		10,950

Abbreviations: Cont.—Continental, Lyc.—Lycoming, GE—General Electric, P&W—Pratt & Whitney, RR—Rolls Royce, Wr—Wright, std—standard, opt—optional, NA—Not Available

* Prices for the 1962 models of these aircraft were not available at the time of going to press. Prices of 1961 Cessnas are: 175, $11,995; 180, $15,275; 182, $15,490; Skylane, $17,950; Skywagon 185, $18,950; 210, $23,450; 310F, $62,500.

PERSONAL & BUSINESS FIXED WING AIRCRAFT

Aircraft designation and Model No.	Number of Seats	Span (feet-inches)	Length (feet-inches)	Height (feet-inches)	Wing Area (sq. ft.)	Weight empty (lbs.)	Maximum gross weight (lbs.)	Powerplant (number, make, model, rating)	Cruising speed (mph)	Maximum speed (mph)	Take-off (over 50 ft.)	Landing (over 50 ft.)	Fuel capacity (gallons)	Maximum range (miles)	Service ceiling (feet)	Basic price ($)
Bellanca 260A 14-19-3A	4	34-2	22-11	6-4	161.5	1,725	3,000	Cont. IO-470-F 260 hp	203	208	672'	940	60	880	22,000	19,500
F-27F	Exec. Inter.	95-2	77	27-6	754	25,000	39,400	2 RR Mk 529 2,105 shp ea.	300	350	2,350	2,060	1,336 to 1,920	1,650 to 2,650	single engine 16,500	800,000 apr.
F-27G	Exec. Inter.	95-2	77	27-6	754	25,000	42,000	2 RR Mk 529 2,105 shp ea.	315	300	2,710	2,060	1,700 to 2,090	2,400 to 3,100	single engine 16,500	800,000 apr.
FU-24	5	42	31-10	9-4	294	2,014	3,500	1 Cont. IO-470-D 260 hp	122	141	915	915	44	350	16,500	22,500
FU-24A	6	42	31-10	9-4	294	2,102	3,500	1 Cont. IO-470-D 260 hp	122	141	915	915	44	350	16,500	22,500
Super Widgeon	6	40	31	9	245	3,200	5,000	2 Cont. O-470 240 hp ea.	150	165	750	NA	108	650	17,000	37,500
G-159 Gulfstream	9-19	78-4	64	22-10	620	20,993	35,000	2 RR Mk 529 2,105 shp ea.	350	370	3,000	2,180	1,550	2,740	36,900	900,000 apr.
G-164 AgCat(ag)	1	35-8	24-4	10-9	326	2,150	3,700	Cont. W670 200 hp	80	114	1,430	NA	34	216	6,900	17,000 apr.
Super-V	4	33	27-8	7	163	1,900	3,400	2 Lyc. O-360 180 hp ea.	200 @75%	210	750	600	100	1,400	23,000 SE 10,000	22,500 plus Basic Air Frame
Helio Super Courier Model H-395	5	39	31	8-10	231	2,037	3,000	1 Lyc. GO-480-G1D6 295 hp	Over 170	189	475	493	60	842	22,500	35,980
Helio Courier Model H-395A	5	39	31	8-10	231	1,965	3,000	1 Lyc. GO-435-C2B26 260 hp	Over 160	189	590	493	60	800	20,050	35,380
Howard "500"	10 to 14	71-2	57-8	13-7	592	22,000	35,000	2 P&W R-2800's or CB-16/17 2,500 hp ea.	350	375	2,590	3,575	1,550	2,600 with: 45 mins. resrv.	35,000	584,000
Lake Amphib LA-4	4	39-2	25	9-4	170	1,575	2,400	1 Lyc. O-360-A1A 180 hp	131	145	Land 650 Water 1,125	Land 475 Water 600	40	627	13,000	26,580
Riviera FN-333	4	34-1	24-3	10-6	162.1	2,092	3,140	IO-470-P 250 hp	140	171	Land 925 Water 1,480	NA	37	1,025	19,000	34,950
L-1329 JetStar	10	53-8	60-5	20-6	532.5	20,030	40,921	4 P&W JT12 3,000 lbs/T. ea.	485	550	NA	NA	2,630	2,650	45,000	1,350,000
LASA 60	6 or cargo	39-4	28-1	10-8	210	2,024	3,532 3,752	Cont. TSIO-470 260 hp	150 @8L	168@ 12,000	1,050	1,050	60	550 with res.	25,000	22,000 apr.
Bee Dee M-4	4	29-8	22	6-2	153	1,100	2,100	Cont. O-300 145 hp	150	NA	900	NA	42	750	12,000	8,500 apr.
Meyers 200B	4	30-6	24-4	7-8	161½	1,920	3,000	Cont. IO-470-D 260 hp	204	220	900	1,150	80	1,380	18,500	24,640
Mark 21 M-20C	4	35	23-2	9-¾	167	1,525	2,575	Lyc. O-360-A 180 hp	180 @75%	190 @8L	600	550	48	1,130	20,000	16,500 apr.
Navion G Rangemaster	5	34-6	27-6	8-6	184½	1,950	3,150	Cont. IO-470-H 260 hp	181	190	980 max 825	980 max 750	108	1,800	20,500	22,625

Abbreviations: Cont.—Continental, Lyc.—Lycoming, GE—General Electric, P&W—Pratt & Whitney, RR—Rolls Royce, Wr—Wright, std—standard, opt—optional, NA—Not Available

PERSONAL & BUSINESS FIXED WING AIRCRAFT

Aircraft designation and Model No.	Number of Seats	Span (feet-inches)	Length (feet-inches)	Height (feet-inches)	Wing Area (sq. ft.)	Weight empty (lbs.)	Maximum gross weight (lbs.)	Powerplant (number, make, model, rating)	Cruising speed (mph)	Maximum speed (mph)	Take-off (over 50 ft.)	Landing (over 50 ft.)	Fuel capacity (gallons)	Maximum range (miles)	Service ceiling (feet)	Basic price ($)
Sabreliner	6 to 10	44-5	43-9	16	342.1	9,307	17,760	2 P&W JT12 3,000 lb/t ea	500	576	NA	NA	1,056	1,725	40,000	750,000 apr.
Marketeer	8-10	71-6	53-6	18-6	540	23,500	35,000	2 P&W R-2800-79 2,000 hp ea.	315	350	3,790	3,000	1,130	2,100	25,000	160,000
Marksman "A" (pressurized)	8-12	70	53-6	18-6	540	24,000	35,000	2 P&W R-2800-83 2,100 hp ea.	325	350	3,790	3,000	800	1,320	25,000	282,430
Marksman "B" (pressurized)	8-12	71-6	53-6	18-6	540	24,000	35,000	2 P&W R-2800-83 2,400 hp ea.	350	385	3,125	3,000	1,130	2,100	26,000	314,475
Marksman "C" (pressurized)	8-12	71-6	53-6	18-6	540	24,000	35,000	2 P&W R-2800CB16/17 2,500 hp ea.	365	400	2,995	2,000 with reverse	1,330	2,500	28,000	361,492
Colt PA-22	2	30	20	6-3	147	940	1,650	Lyc. O-235-C1B 108 hp	115	120	1,500	1,250	36	690	12,000	4,995
Super Cub PA-18	2	35-3	22-5	6-7	178.5	930	1,750	Lyc. O-320 150 hp	115	130	500	350	36	460	19,000	7,880
Pawnee PA-25	1	36-2	24	6-8	183	1,200	2,300	Lyc. O-320 150 hp	100	113	1,375	440	40	440	11,300	9,650
Cherokee PA-28-150	4	30	23-3	7-3	160	1,185	2,150	Lyc. O-320 150 hp	130	136	800	535	50	880	14,300	9,795
Cherokee PA-28-160	4	30	23-3	7-3	160	1,195	2,200	Lyc. O-320-B2B 160 hp	132	138	775	550	50	900	15,000	9,995
Comanche PA-24-180	4	36	24-7	7-3	178	1,510	2,550	Lyc. O-360-A 180 hp	160	167	750	600	60	1,100	18,500	16,445
Comanche PA-24-250	4	36	24-9	7-3	178	1,630	2,900	Lyc. O-540-A1A5 250 hp	181	190	1,000	650	90	1,650	20,000	20,485
Apache G PA-23-160	5	37	27-1	9-5	207	2,320	3,800	2 Lyc. O-320-B 160 hp ea.	171	183	1,190	750	108	1,260	17,000	37,990
Aztec PA-23-250	5	37	27-6	10-3	207	2,775	4,800	2 Lyc. O-540-A 250 hp ea.	205	215	1,100	1,260	144	1,400	21,000	52,990
Meteor II	4	36	27	7	180	2,200	3,800	2 Lyc. O-360-A1A 180 hp ea.	200	220	NA	NA	120	900	20,500	NA
2150-A	2	30	21-2	7	144	1,125	1,817	Lyc. O-320-A2B 150 hp	135	148	440	450	35	525	22,000	8,950
SGS1-23H Sailplane	1	52-8	20-10	7-6	164	480	750	NONE	87.5	140						4,695
SGS1-23H15 Sailplane	1	49-2	20-10	7-6	159.4	474	750	NONE	87.5	140						4,695
SGS 1-26 Sailplane	1	40	21-3	7-2	160	348	575	NONE	77	104						1,995 (kit) 3,395 (complete)
SGU2-22C Sailplane	2	43	25-8	9	210	450	900	NONE	60	90						2,495 (kit) 3,450 (complete)
Stits Sky Coupe Model SA9A	2	28-6	19-2	8-11	125	1,000	1,525	Cont. O-200 100 hp	115	125	1,275	1,250	24	510	12,000	Kits and drawings
Cavalier 2000	2	40-1	32-2	12-2	272.3	7,121	10,500	Packard-Merlin 1,495 hp	424	457	1,850	1,750	376	2,000	40,000	32,500
Agricultural Ag-2	2	42	28-5	9-8	321.6	3,608	7,700	P&W R1340 600 hp	130	142	1,220	350	125			on request
DHC-2 Beaver	8	48	30-4	9	250	2,960	5,100	P&W R985 450 hp	163	163	1,015	1,015	95 US	565NM	18,000	45,000
DHC-3 Otter	12	58	41-10	13	375		8,000	P&W R1340 600 hp	138	160	1,000	1,000	216 US	766NM	17,400	85,000
FBA-2B	4-5	36	25-6	9	180	1,550	2,850	Lyc. O-540 250 hp	133	145	900		56	610	16,000	
FBA-2C	4-5	36	25-6	7-8	180	1,550	2,850	Lyc. O-540 250 hp	133	145	900		56	610	16,000	less than 20,000

Abbreviations: Cont.—Continental, Lyc.—Lycoming, GE—General Electric, P&W—Pratt & Whitney, RR—Rolls Royce, Wr—Wright, std—standard, opt—optional, NA—Not Available

56,000 single-engine of four-place and over. By 1975 the fleet should number 120,000. Next year alone should see the production of 9,000 new airplanes.

Hours flown by general aviation should jump from today's 12.5 million to 15.7 million in 1965, 18.5 million in 1970 and up to 21 million in 1975. Business flying alone, which now accounts for about 5.5 million hours a year, should reach six million hours in 1965, eight million by 1975. This one segment of general aviation today flies more hours than the combined airlines.

From January through July of this year, eight companies reported a total of 4,128 aircraft sold, for $76,052,000, according to Aerospace Industries Assn. of America, Inc. This was a drop of 778 aircraft, and $20,381,000 in sales, as compared with the same seven-month period last year. Upcoming new models, design changes, plus the general U.S. recession generated the slow-down. Sharp and continuing upturn should make 1962 the biggest year ever for general aviation.

Of the 4,128 aircraft sold, 575 were light twins. Again, of the total units, Aero Commander moved 82 for the seven-month period, Beech 508 models, Call Air 18, Cessna 1,661 units; Champion sold 79, Lake eight, Mooney 145 and Piper 1,627 airplanes. Gains were registered by Aero Commander, Call Air and Mooney.

Tables accompanying this report feature key performance-specification details of aircraft now in production or to be available in 1962. Piston-powered aircraft predominate, and will top the market during the 60's. While heavier turbine-powered models are increasingly penetrating the general aviation fleet (Lockheed JetStar, Grumman Gulfstream, Fairchild F-27), upcoming light-to-medium twin turbines are just around the corner—such as the short-field, 14,000-pound Jet Commander Model 1121 and the 17,760-pound North American T-39 Sabreliner, now flying with USAF.

What are the plans of the major aircraft companies for the period just ahead? How will their thinking change the general aviation picture?

Piper Aircraft Corp., for the long haul, plans gradual improvements of its twin and single-engine line. It moved 757 of its two-place Colt model during the first seven months this year, a high for single model sales (for any company) during this period. The Lock Haven company is now experimenting—at its Vero Beach development center—with its new two-place low-wing Papoose, which may be of fibreglass construction.

Piper also is flying its Comanche with a new version of the Lycoming 0-580 flat eight-cylinder engine rated at 400 hp at 3,300 rpm. Company reportedly is also considering a new twin-Comanche that will sell for less than $30,000 and cruise about 190 mph. Power would be supplied by two fuel-injected four-cylinder 155-hp Lycomings. In addition, Cherokee on floats is expected to be marketed in the spring of 1962.

For 1962, William T. Piper Jr., executive vice president, feels that "Piper sales will increase to $43-45 million . . . unit production is expected to exceed 3,600 aircraft."

Cessna Aircraft Co. (Wichita, Kans.) this month heralded a new era in introducing its 13-aircraft "anniversary fleet"—symbolic of its "50 Years of Progress" since Clyde Cessna built (*Continued on page* 112)

Mooney Mark 21

Piper Colt

Beech Baron

Piper Comanche 180

Cessna 150

New markets and increased capabilities are forecast on the basis of both heightened performance, new economy

ROTARY-WING AIRCRAFT

By FLYING STAFF

THE WHIRLING BLADES of a second generation of aircraft are stirring up new enthusiasm and optimism for the future in the rotary-wing field. The wedding of the helicopter and the turbine engine has resulted in significant increases in speed, altitude and load capacity plus new promise of economy.

The broadening of technical horizons coupled with the solid progress made by general aviation in extending the scope and volume of business with proven and refined piston-powered rotorcraft provide a solid foundation for a continued pattern of growth.

Advances in commercial as well as airline operations can be measured in large percentages, marking a successful combination of enterprise and imagination in extending markets and increasing service and efficiency.

Commercial helicopter operators in the United States and Canada have developed what is now a $50 million business annually, excluding the helicopter airlines, according to a survey by the Helicopter Council of the Aerospace Industries Assn.

A total of 265 commercial helicopter operators use 882 helicopters, representing approximately double that of two years ago in each category. In addition, over 100 corporations operate executive transport helicopters, compared with 75 two years ago. At that time 12 governmental agencies operated 29 helicopters; now

Bell 47G-3B

Cessna Skyhook

Hiller E4 "Flying Station Wagon"

Brantly B-2

Hughes 269A

PERSONAL & BUSINESS ROTARY WING AIRCRAFT

Manufacturer	Aircraft designation and Model No.	Number of seats	Overall length (feet-inches)	Overall height (feet-inches)	Rotor diameter (feet-inches)	Weight empty (lbs.)	Maximum gross weight (lbs.)	Powerplant (number, make, model, rating)	Maximum speed (mph)	Hovering ceiling (IGE)	Fuel capacity (gallons)	Maximum range (miles)	Basic price ($)
Bell Helicopter Co. Fort Worth, Tex.	47G-2A* Trooper	3	41-6	9-4	37-3	1,640	2,850	Lyc. VO-435 240 hp	105	9,000	41	225 at 5,000	39,950
	47G-3B*	3	41-6	9-4	37-3	1,713	2,850	Lyc. TVO-435 260 hp	105	22,300	41	238 at S.L.	45,950
	47J-2* Ranger	4	43-2	9-3	37-3	1,730	2,850	Lyc. VO-540 240 hp	105 at S.L.	9,000	48	270 at 5,000	69,950
	204B	10	52-11	13-6.5	44	4,318	6,500 pass 8,500 car	Lyc. T53-L9 1,100 shp	147 at S.L.	17,600	155	260	300,000 apr.
Bensen Aircraft Corp. Raleigh, N. C.	B-8M Gyrocopter	1	11-4	6-3	20	247	600	McCulloch 4318E	85		6.0	100	2,995
	B-9 Little Zipster	1	11-3	8-8	22 20	450	800	Mercury MK 78	80	6,000	6.0	100	6,995
The Boeing Company Vertol Division Morton, Pa.	V107-II	27	83-4	16-10	2 rotors 50 ea.	11,160	18,450	2 GE CT58 1,250 shp ea.	162	12,800	NA	230	500,000 apr.
Brantly Helicopter Corp. Gilbert, Ind.	B-2	2	19-4	6-10	23-8	980	1,600	Lyc. VO-360-A1A	100	13,000	31	300	19,950
Cessna Aircraft Company Wichita, Kan.	Skyhook	4	42-6	8-5	35	2,080	3,100	Cont FSO 526A 270 hp	122	6,500	60 (std) 90 (opt)	400	79,900
Doman Helicopters, Inc. Danbury, Conn.	Doman-Ambrosini Model D-10A	8	38-0	10-5	48.0	3,327	5,500	Lyc. IO-720-A1A 400 hp	98	4,700 max. gr. wt.	119	322 at max gross	100,000
Hiller Aircraft Corp. Palo Alto, Calif.	12E	3	27-8	9-8	35-4	1,700	2,750	Lyc. VO-540 305 hp	96	6,400	46	225	59,950
	12E with high compression pistons (optional)	3	27-8	9-8	35-4	1,702	2,750	Lyc. VO-540 305 hp	96	10,000	46	225	60,775
	E4	4	29-8	9-8	35-4	1,775	2,750	Lyc. VO-540 305 hp	96	7,800	46	225	69,900
	E4, with high compression pistons (optional)	4	29-8	9-8	35-4	1,777	2,750	Lyc. VO-540 305 hp	96	11,400	46	225	70,785
Hughes Tool Co., Aircraft Div. Culver City, Calif.	269A	2	22-3	7-11	25	807	1,550	Lyc. O-360-C2D 180 hp	90	6,000	25	210	22,500
Kaman Aircraft Corp. Bloomfield, Conn.	H-43B	5-12	47	12-7	2 rotors 47-10 ea.	4,469	5,900	Lyc. T53-L1 860 shp	120	21,000	185	236	NA
Omega Aircraft Corp. New Bedford, Mass.	BS-12D-1 Flying Crane	5	48-8	13	39	4,350	4,880	2 Lyc. O-540-F1A5 260 hp ea	95	4,000	76	NA	NA
Republic Aviation Corp. Farmingdale, N. Y.	Alouette II SE 3130	5	31-10	9	33-6	1,874	3,300	Turbomeca Artouste 11C1 480 hp	117	6,000	157	345	105,600
Sikorsky Aircraft Div. United Aircraft Corp. Stratford, Conn.	S-58B	18	65-10	15-11	56	7,630	13,000	Wr 989C9HE2 1,525 hp	123	4,900	290	260	209,250
	S-62	11	62-3	14-2	53	4,789	7,500	GE CT58-100-1 1,050 shp	109	14,000	182	270	273,485
	S-61L	25 to 28	72-8	16-8	62	9,270	18,700	2 GE T58-8 1,250 shp ea.	147	7,000	390	350	695,000
Umbaugh Aircraft Corp. Enid, Okla.	18 (Gyroplane)	2	19-10	9-8	35	1,215	1,800	Lyc. O-360 180 hp	125		29	300	9,995

Abbreviations: Cont.—Continental, Lyc.—Lycoming, GE—General Electric, P&W—Pratt & Whitney, Wr—Wright, shp—shaft horse power, Std—standard, opt—optional, NA—Not Available
*** Performance of Bell 47G2A and 47G-3B based on 2,450 lbs. weight; 47J-2 2,550 lbs.**

34 operate 123. Commercial and business operations cover the spectrum from executive transport to aerial crane work and real estate evaluation, from industrial charter work to inter-plant deliveries, pipe line construction, fire fighting, spraying and timber surveys, and a myriad of others.

These missions are performed in rotorcraft whose numbers and variety give added testimony to the vitality and potential of the industry.

The aircraft range in size from the nimble Brantly B-2 and Hughes 269A, both seating two, up through the three and four-place Hiller 12E and E4 series; from the turbine-powered single rotor Bell 204B and Sikorsky S-62 up to the giant twin-turbine Sikorsky S-64 Skycrane being prepared for its first flight and designed to lift a 20,000-pound payload, half its own gross weight.

Some, such as the Omega BS-12D-1 five-place helicopter, aim at special versatility by incorporating cargo pods, with passenger pod capability slated for future models.

Others, like Bell's new turbo-supercharged 47G-3B, give high-altitude performance such as that demanded by operators in the Sierra Nevada and Rocky Mountains, and from mining operators in the Bolivian and Chilean Andes. The three-place aircraft can hover in ground effect with a useful load of 1,100 pounds at altitudes up to 18,000 feet.

A pioneer in opening new aeronautical frontiers for single-engine rotorcraft in the direction of all-weather capability is the four-place Cessna Skyhook. This highly maneuverable helicopter was the first to be certificated for IFR operation. It set three world altitude records in two weight classes by climbing to nearly 30,000 feet.

Enhancing the overall IFR capability outlook for helicopters of all types are bold new instrument flight techniques now under development. The Army-Navy Instrument Program (ANIP) is engaged in evaluating new instruments designed specifically for the helicopter, and pictorial display methods promising dramatic simplification of all-weather flight.

Another new helicopter of novel design is being flown in testbed configuration by Lockheed Aircraft Corp. Lockheed says the two-place rotocraft is the first to successfully use the inherently stable gyro effect of the rotor blades for control simplification. The helicopter uses a rigid rotor with non-articulated blades.

The project has been federally funded for continuing engineering research. Lockheed, which has been independently working on it for four to five years, feels it is "a very serious project with significant potential."

Among the more unique proposals in the cargo field is the STORC (Self Ferrying Trans Ocean Rotary-wing Crane) outlined by Hiller Aircraft Corp. Under this concept a large transport helicopter with turbojets mounted in the blade tips could be converted into a fixed-wing aircraft. The vehicle then could transport itself to any point on the globe.

Indicative of Federal Aviation Agency attention to rotary-wing needs and problems have been the issuing of the FAA Heliport Design Guide in December 1959 and launching of Project Hummingbird for study and analysis of helicopter operations. A report on short-haul commercial transportation projected over the next 10 years has already been published as a result.

In the light of all these developments, how do manufacturers regard the future?

Bell Helicopter Co. estimates a growth rate in helicopters of approximately 20 per cent per year not only in the United States, but throughout the world. And although noting that today's helicopter is expensive to manufacture (see *Why Aircraft Cost Money* in this issue) and the cost of operation still relatively high, Bell expects that in 1965 the advent of light turbine-powered helicopters designed for low manufacturing costs and high production rates will bring about an accelerated drop in costs.

Bell is one of three firms engaged in the Army light observation helicopter competition, which is expected to have a far-reaching effect on commercial models. Competition has reached a high pitch, as quantity production of the winning design is expected ultimately to exceed 4,000. The three competitors are the Bell D-250 design, the Hiller Model 1100 and the Hughes 369. The four-place helicopter initially will be powered by the Allison T-63 turbine engine of 250 shp.

Another major helicopter market with great potential —airport transportation, travel between airport and city —is the target of vigorous and enthusiastic campaigning by helicopter groups.

Only last June another new passenger operation was launched—San Francisco-Oakland Helicopter Airlines—bringing to four the metropolitan areas currently provided with scheduled helicopter service. But applications still are pending in a great number of cities.

Foremost among these is Washington, D. C. and service for the Dulles International-Washington National-Baltimore Friendship airport complex.

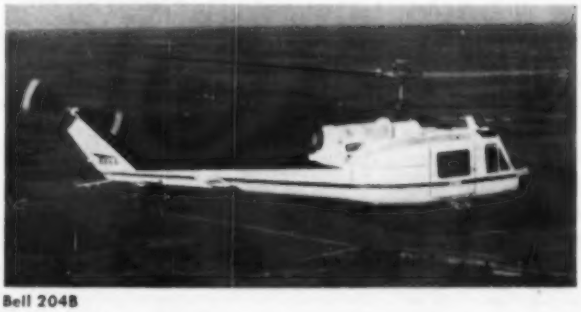
Indicative of the rapid (*Continued on page* 153)

Sikorsky S-62

Republic Alouette

Omega BS 12-D1

Kaman Huskie H-43B



Bell 204B

Great potential is forecast for the union of turbines and lightplanes, but piston engines offer new advances

POWERPLANTS- PISTON & TURBINE

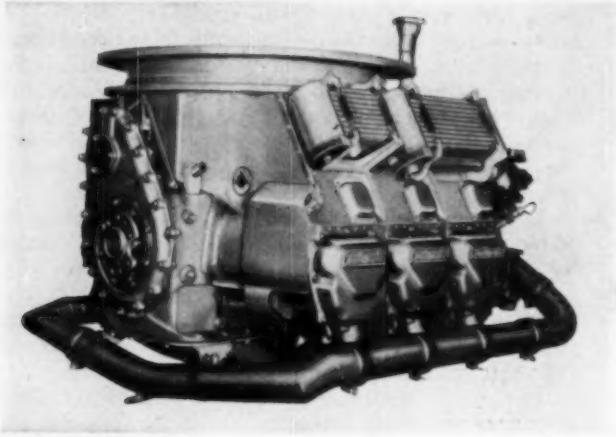
By FLYING STAFF

THE RACE to bring gas turbine-powered lightplanes into the U. S. market on a large scale is rapidly picking up momentum. The events of the past year have strengthened industry-wide predictions that gas turbine engines will be available on a number of light twins by 1965. In addition it appears that the dam of uncertainty is being swept completely away and that U. S. lightplane manufacturers will have a complete line of gas turbine-powered, single- and twin-engined aircraft in their sales rooms by 1967-68.

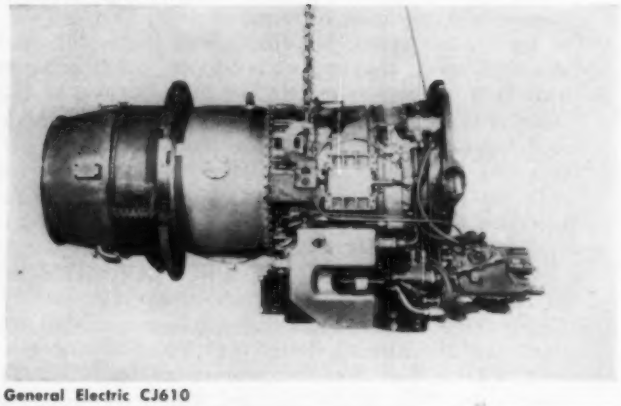
While fine progress is being made by both engine and airframe companies as they marry the gas turbine to the lightplane for the mass market, two problems are still critical. First and foremost is the cost problem. Gas turbine engines are going to bring major improvements in cruise speed, maintenance simplicity, high-altitude, over-the-weather flight, etc., but all of these benefits can be counteracted if the sales cost is completely out of line with piston engine prices.

Today most manufacturers apparently believe that they can get costs down low enough to sell their first turbine-powered twins for about 50 per cent more than piston engined airplanes of the same general size. Presumably, personal aircraft using a single gas turbine will have to sell for less than 50 per cent more than their piston-powered counterparts.

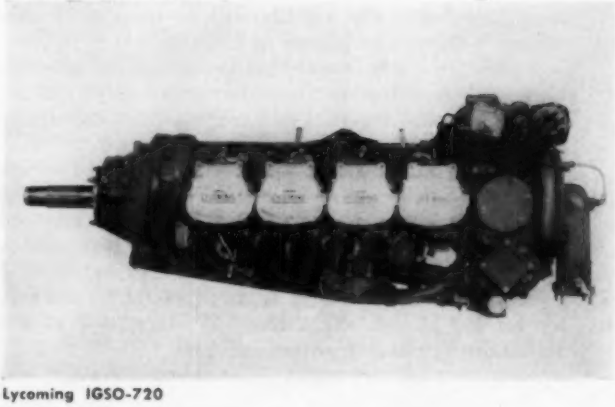
Canadian Pratt & Whitney PT-6



Continental FSO-526-A



General Electric CJ610



Lycoming IGSO-720

RECIPROCATING ENGINES

Manufacturer	Engine designation and Model No.	Number of cylinders	Cylinder arrangement	Propeller drive	Maximum take-off power Sea level hp and rpm	Normal rated power (hp and rpm)	Altitude for normal rated power	Engine dimension (inches)	Displacement (cu. in.)	Fuel grade	Dry weight (lbs.)
Continental Motors Corp., Inc., Muskegon, Mich.	A65-8F	4	HO	Direct	65 @ 2,300	65 @ 2,300	SL	L-31.00 W-31.56 H-20.31	171	80/87	170
	C85-8F	4	HO	Direct	85 @ 2,575	85 @ 2,575	SL	L-23.31 W-31.56 H-20.31	188	80/87	178
	C85-12F	4	HO	Direct	85 @ 2,575	85 @ 2,575	SL	L-31.25 W-31.56 H-23.50	188	80/87	180
	C90-8F	4	HO	Direct	95 @ 2,625	90 @ 2,475	SL	L-23.31 W-31.56 H-20.31	201	80/87	184
	C90-12F	4	HO	Direct	95 @ 2,625	90 @ 2,475	SL	L-31.25 W-31.56 H-23.50	201	80/87	188
	E185-11	6	HO	Direct	205 @ 2,600	185 @ 2,300	SL	L-47.62 W-33.38 H-23.00	471	80/87	344
	E225-4	6	HO	Direct	205 @ 2,600	185 @ 2,300	SL	L-47.62 W-33.38 H-25.00	471	80/87	355
	E225-8	6	HO	Direct	225 @ 2,650	225 @ 2,650	SL	L-47.62 W-33.38 H-23.00	471	80/87	347
	O-200-A	4	HO	Direct	100 @ 2,750	100 @ 2,750	SL	L-30.53 W-31.56 H-23.50	201	80/87	190
	O-300-A	6	HO	Direct	145 @ 2,700	145 @ 2,700	SL	L-38.38 W-31.50 H-27.41	301	80/87	298
	O-300-B	6	HO	Direct	145 @ 2,700	145 @ 2,700	SL	L-38.38 W-31.50 H-27.41	301	80/87	298
	O-300-C	6	HO	Direct	145 @ 2,700	145 @ 2,700	SL	L-38.88 W-31.50 H-27.41	301	80/87	298
	O-300-D	6	HO	Direct	145 @ 2,700	145 @ 2,700	SL	L-36.00 W-31.50 H-26.91	301	80/87	298
	GO-300-A	6	HO	Geared	175 @ 3,200	175 @ 3,200	SL	L-39.62 W-31.50 H-27.62	301	80/87	314
	GO-300-B	6	HO	Geared	175 @ 3,200	175 @ 3,200	SL	L-39.62 W-31.50 H-27.62	301	80/87	314
	GO-300-C	6	HO	Geared	175 @ 3,200	175 @ 3,200	SL	L-39.62 W-31.50 H-26.56	301	80/87	314
	GO-300-D	6	HO	Geared	175 @ 3,200	175 @ 3,200	SL	L-39.69 W-31.50 H-26.56	301	80/87	314
	GO-300-E	6	HO	Geared	175 @ 3,200	175 @ 3,200	SL	L-39.69 W-31.50 H-26.56	301	80/87	314
	O-470-A	6	HO	Direct	225 @ 2,600	225 @ 2,600	SL	L-36.03 W-33.32 H-27.75	471	80/87	378
	O-470-E	6	HO	Direct	225 @ 2,650	225 @ 2,600	SL	L-43.31 W-32.32 H-19.62	471	80/87	390
	O-470-J	6	HO	Direct	225 @ 2,550	225 @ 2,550	SL	L-36.03 W-33.32 H-27.75	471	80/87	378
	O-470-K,-L,-R	6	HO	Direct	230 @ 2,600	230 @ 2,600	SL	L-36.03 W-33.56 H-27.75	471	80/87	404
	O-470-B,-M,-N	6	HO	Direct	240 @ 2,600	240 @ 2,600	SL	L-43.31 W-33.56 H-19.62	471	91/96	410
	O-470-G & P	6	HO	Direct	240 @ 2,600	240 @ 2,600	SL	L-37.56 W-33.56 H-26.69	471	91/96	432
	O-470-H	6	HO	Direct	240 @ 2,600	240 @ 2,600	SL	L-67.65 W-33.56 H-19.62	471	91/96	495
	IO-470-A	6	HO	Direct	240 @ 2,600	240 @ 2,600	SL	L-43.53 W-33.56 H-19.62	471	91/96	410
	IO-470-C	6	HO	Direct	250 @ 2,600	250 @ 2,600	SL	L-37.93 W-33.56 H-26.81	471	91/96	432
	IO-470-D	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-43.53 W-33.56 H-19.75	471	100/130	426
	IO-470-E	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-42.56 W-33.56 H-19.75	471	100/130	429
	IO-470-F	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-37.27 W-33.56 H-23.79	471	100/130	426
	IO-470-G	6	HO	Direct	250 @ 2,600	250 @ 2,600	SL	L-42.26 W-33.56 H-19.75	471	91/96	429
	IO-470-H	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-37.93 W-33.56 H-26.81	471	100/130	432
	IO-470-J	6	HO	Direct	225 @ 2,600	225 @ 2,600	SL	L-37.93 W-33.56 H-26.81	471	80/87	402
	IO-470-K	6	HO	Direct	225 @ 2,600	225 @ 2,600	SL	L-37.93 W-33.56 H-26.81	471	80/87	402
	IO-470-L	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-44.02 W-33.56 H-19.75	471	100/130	429
	IO-470-M	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-47.16 W-33.56 H-19.75	471	100/130	431
	IO-470-N	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-38.14 W-33.56 H-26.81	471	100/130	432
	IO-470-P	6	HO	Direct	250 @ 2,600	250 @ 2,600	SL	L-66.93 W-33.56 H-19.62	471	91/96	472
	IO-470-R	6	HO	Direct	250 @ 2,600	250 @ 2,600	SL	L-43.26 W-33.56 H-19.75	471	91/96	429
	IO-470-S	6	HO	Direct	260 @ 2,625	260 @ 2,625	SL	L-40.91 W-33.56 H-19.75	471	100/130	429
	TSIO-470-B (Turbocharged)	6	HO	Direct	260 @ 2,600	260 @ 2,600	SL to 16,000	L-42.82 W-33.56 H-20.25	471	100/130	427
	FSO-526-A (Helicopter)	6	HO	Direct	270 @ 3,000	270 @ 3,000	SL 7,900	L-50.33 W-36.64 H-28.54	526	91/96	553
Lycoming Division Avco Manufacturing Corp., Stratford, Conn.	O-235-C1B	4	HO	Direct	115 @ 2,800	108 @ 2,600	SL	L-30 W-32 H-22	233.3	80	240
	O-290-D2C	4	HO	Direct	140 @ 2,800	135 @ 2,600	SL	L-32 W-30 H-23	289	80/87	264
	O-290-D2C (Helicopter)	4	HO	Direct	135 @ 2,600	135 @ 2,600	SL	L-32 W-30 H-23	289	80/87	264
	O-320-A2C	4	HO	Direct	150 @ 2,700	150 @ 2,700	SL	L-32 W-30 H-30	319.8	80/87	271
	O-320-A2C (Helicopter)	4	HO	Direct	150 @ 2,700	150 @ 2,700	SL	L-32 W-30 H-23	319.8	80/87	271
	O-320-B2C	4	HO	Direct	160 @ 2,700	160 @ 2,700	SL	L-32 W-30 H-30	319.8	91/96	277
	O-320-B3C	4	HO	Direct	160 @ 2,700	160 @ 2,700	SL	L-32 W-30 H-30	319.8	91/96	277
	O-340-A1B	4	HO	Direct	170 @ 2,700	170 @ 2,700	SL	L-33 W-30 H-25	340	91/96	278
	O-360-A1D	4	HO	Direct	180 @ 2,700	180 @ 2,700	SL	L-33 W-30 H-25	361	91/96	284
	O-360-A1C	4	HO	Direct	180 @ 2,700	180 @ 2,700	SL	L-33 W-31 H-20	361	91/96	288
	O-360-B1A	4	HO	Direct	2,700	2,700	SL	L-33 W-33 H-22	361	91/96	291
	O-360-C2D (Helicopter)	4	HO	Direct	180 @ 2,700	180 @ 2,700	SL	L-33 W-31 H-20	361	91/96	288
	VO-360-A1B (Helicopter)	4	Vertical	Direct	180 @ 2,900	180 @ 2,900	SL	L-33 W-30 H-23	361	91/96	298
	GO-435-C2B2-6	6	HO	Geared	260 @ 3,400	240 @ 3,000	SL	L-33 W-39 H-28	434	80/87	430
	O-435-4 (Helicopter)	6	HO	Direct	255 @ 3,400	245 @ 3,200	SL	L-33 W-39 H-28	434	80/87	405
	VO-435-A1E (Helicopter)	6	Vertical	Direct	260 @ 3,400	250 @ 3,200	SL	L-34 W-35 H-25	434	80/87	391
	O-435-6A (Helicopter)	6	HO	Direct	255 @ 3,400	245 @ 3,200	SL	L-34 W-35 H-25	434	80/87	405
	O-435-23B (Helicopter)	6	HO	Direct	255 @ 3,400	245 @ 3,200	SL	L-34 W-35 H-25	434	80/87	403
	TVO-435-A1A (Helicopter)	6	Vertical	Direct	260 @ 3,200	220 @ 3,200	SL	L-34 W-35 H-37	434	100/130	468
	GO-480-B1E-6	6	HO	Geared	270 @ 3,400	260 @ 3,000	SL	L-33 W-40 H-28	479.7	80/87	432
	GO-480-B1D	6	HO	Geared	270 @ 3,400	260 @ 3,000	SL	L-33 W-39 H-28	479.7	80/87	432
	GO-480-G1G6	6	HO	Geared	295 @ 3,400	280 @ 3,000	SL	L-33 W-40 H-28	479.7	100/130	439
	GO-480-G1F6	6	HO	Geared	295 @ 3,400	280 @ 3,000	SL	L-33 W-40 H-28	479.7	100/130	437
	GO-480-G2F6	6	HO	Geared	295 @ 3,400	285 @ 3,100	SL	L-33 W-42 H-28	479.7	100/130	442
	GSO-480-B1A6	6	HO	Geared	340 @ 3,400	320 @ 3,200	8,000	L-33 W-49 H-33	479.7	100/130	498
	GSO-480-B1B6	6	HO	Geared	340 @ 3,400	320 @ 3,200	8,000	L-33 W-46 H-33	479.7	100/130	500
	GSO-480-B1C6	6	HO	Geared	340 @ 3,400	320 @ 3,200	8,000	L-33 W-52 H-23	479.7	100/130	497
	GSO-480-B2D6	6	HO	Geared	340 @ 3,400	320 @ 3,200	8,000	L-33 W-47 H-23	479.7	100/130	498
	IGSO-480-A1B6	6	HO	Geared	340 @ 3,400	320 @ 3,200	11,000	L-33 W-48 H-23	479.7	100/130	497
	O-540-A1D5	6	HO	Direct	250 @ 2,575	250 @ 2,575	SL	L-33 W-38 H-25	541.5	91/98	397
	IO-540-A1A	6	HO	Direct	290 @ 2,575	290 @ 2,575	SL	L-34 W-40 H-20	541.5	100/130	441
	IO-540-B1A5	6	HO	Direct	290 @ 2,575	290 @ 2,575	SL	L-34 W-39 H-20	541.5	100/130	437
	IGO-540-A1A	6	HO	Geared	350 @ 3,400	325 @ 3,000	SL	L-34 W 44 H-22	541.5	100/130	510
	IGO-540-B1A	6	HO	Geared	350 @ 3,400	325 @ 3,000	SL	L-34 W 44 H-22	541.5	100/130	504
	IGSO-540-A1A	6	HO	Geared	380 @ 3,400	360 @ 3,200	11,500	L-34 W-48 H-20	541.5	100/130	538
	TVO-540-A1A (Helicopter)	6	Vertical	Direct	305 @ 3,200	305 @ 3,200	SL	L-35 W-35 H-38	541.5	100/130	499
	IGSO-540-B1A	6	HO	Geared	380 @ 3,400	360 @ 3,200	11,500	L-34 W-48 H-20	541.5	100/130	532
	O-540-F1B5 (Helicopter)	6	HO	Direct	260 @ 2,800	235 @ 2,800	4,000	L-33 W-38 H-25	541.5	91/96	398
	VO-540-B1C (Helicopter)	6	Vertical	Direct	305 @ 3,200	305 @ 3,200	SL	L-35 W-35 H-25	541.5	80/87	430
	VO-540-B1B (Helicopter)	6	Vertical	Direct	305 @ 3,200	305 @ 3,200	SL	L-35 W-35 H-25	541.5	80/87	429
	VO-540-B1D (Helicopter)	6	Vertical	Direct	305 @ 3,200	305 @ 3,200	SL	L-35 W-35 H-25	541.5	80/87	437
	VO-540-C1A (Helicopter)	6	Vertical	Direct	305 @ 3,200	305 @ 3,200	SL	L-35 W-35 H-25	541.5	100/130	439
Nelson Specialty Corp., New Leandro, Calif.	H-63CP (Two cycle)	4	HO	Direct	48 @ 4,400	NA	NA	L-20 W 23.8	63	80/87	67

Abbreviations: HO—Horizontal Opposed L—Length W—Width H—Height SL—Sea Level NA—Not Available

GAS-TURBINE ENGINES

Manufacturer	Engine designation and Model No.	Type	No. of compressor stages	No. of turbine stages	No. of combustors	Maximum power at sea level	Specific fuel consumption at maximum power	Compression ratio at maximum rpm	Engine dimension (inches)	Dry weight (lbs.)	Application
Allison Division, General Motors Corp. Indianapolis, Ind.	250-B-2 (T-63)	Free Turbine	6(A) 1(C)	3	1	250 @ 2,057 rpm	.71	NA	L-40 Dia-15.5	110	Fixed Wing Aircraft
	250-C-2 (T-63)	Free Turbine	6(A) 1(C)	3	1	250 @ 6,022 rpm	.71	NA	L-37.3 Dia-15.5	95	Helicopter
The Boeing Airplane Co. Seattle, Wash.	T50-BO-4	Turboshaft FT (C)	1	2	2	270 shp	1.02	4.4	L-41.5 Dia-24	330	Helicopter
	502-10W	Turboprop FT (C)	1	2	2	325 shp	.89	4.56	L-44.8 Dia-24	325	Fixed Wing Aircraft
	502-14	Turboshaft FT (C)	1	2	2	330 shp	.85	4.4	L-34 Dia-22.5	222	Helicopter
	502-18	Turboshaft FT (AF&C)	2	2	2	375 shp	.78	4.8	L-37.8 Dia-22.5	215	Helicopter
	T60-BO-2	Turboshaft FT (C)	1	2	2	430 shp	.72	6.5	L-57.5 Dia-25.2	315	Helicopter
	520-4	Turboprop FT (C)	1	2	2	475 shp	.71	6.4	L-68.7 Dia-25.5	325	Fixed Wing Aircraft
	520-6	Turboshaft FT (C)	1	2	2	550 shp	.65	6	L-57.5 Dia-25.2	250	Helicopter
	520-8	Turboprop FT (C)	1	2	2	550 shp	.65	6	L-68.7 Dia-25.5	275	Fixed Wing Aircraft
Continental Aviation and Engineering Corp. Detroit, Mich.	CJ69-1025 (J69-T-25)	Turbojet	1	1	1	1,025 lb/t	1.14	4.1	Dia-22.3	364	Fixed Wing Aircraft
	CJ69-1400	Turbojet	2	1	1	1,400 lb/t	1.04	5.1	Dia-22.3	370	Final Development
	217-5A	Turboshaft	2	3	1	500 hp	0.67	6.1	Dia-19.38	210	Final Development
	217-6A	Turboprop	2	3	1	500 hp	0.67	6.1	Dia-19.38	235	Final Development
	356-16	Turbofan	2	2	1	2,600 lb/t	0.75	5.1	Dia-29.6	480	Development
	356-23	Turbojet	3	2	1	2,400 lb/t	0.98	6.1	Dia-22.3	410	Development
	356-24	Turbofan	3	3	1	4,000 lb/t	0.64	6.1	Dia-34.5	598	Development
	141	Turbo-Compressor	1	2	1	191 Air hp		3.9		197	Helicopter
Turbomeca, Bordes, France via Continental Aviation & Engineering Corp.	231-2 (Astazou II)	Turboprop	2	3	1	522 hp	0.66	5.75	Dia-18.11	290	Fixed Wing Aircraft
	235-4 (Bastan IV)	Turboprop	2	3	1	916 shp	0.67	5.75	Dia-29.13	465	Fixed Wing Aircraft
General Electric Co. Small Aircraft Engine Dept. Lynn, Mass.	CJ610-1	Turbojet	8	2	1	2,850 lb/t	NA	7	L-41 Dia-17.7	355	Fixed Wing Aircraft
	CJ610-2B	Turbojet	8	2	1	2,400 lb/t	NA	7	L-41 Dia-17.7	355	Fixed Wing Aircraft
	CF700-2B	Turbofan	8	2	1	4,200 lb/t	NA	7	L-65 Dia-34	640	Fixed Wing Aircraft
	CT58-100-1	Turboshaft	10	2+1	1	1,050 shp	0.64	8.3	L-55 Dia-16	280	Helicopter
	CT58-100-2	Turboshaft	10	2+1	1	1,050 shp	0.64	8.3	L-55 Dia-16	295	Helicopter
	CT58-110-1	Turboshaft	10	2+1	1	1,250 shp	0.61	8.3	L-55 Dia-16	295	Helicopter
	T64-GE-4	Turboprop	14	2+2	1	2,850 shp	0.49	12.6	L-113 Dia-46	1,136	Fixed Wing Aircraft
	T64-GE-8	Turboprop	14	2+2	1	2,850 shp	0.49	12.6	L-113 Dia-46	1,136	Fixed Wing Aircraft
Lycoming Division, Avco Manufacturing Co. Stratford, Conn.	T53-L-1A&1B	Turboshaft FT	5(A)	1(C)	1	860 shp	.770	1	L-47.6 Dia-24	484	Helicopter
	T53-L-5	Turboshaft FT	5(A)	1(C)	1	960 shp	.694	1	L-47.6 Dia-24	487	Helicopter
	T53-L-9	Turboshaft FT	5(A)	1(C)	1	1,100 shp	.682	1	L-47.8 Dia-24	485	Helicopter
	T55-L-3	Turboshaft FT	7(A)	1(C)	1	1,900 shp	.670	1	L-36.7 Dia-24.25	600	Helicopter
	T55-L-5	Turboshaft FT	7(A)	1(C)	1	2,200 shp	.622	1	L-44 Dia-24.25	570	Helicopter
	LTC4B-8	Turboshaft FT	7(A)	1(C)	1	2,500 shp	.597	1	L-44 Dia-24.25	570	Helicopter
	T53-L-3	Turboshaft FT	5(A)	1(C)	1	1,005 shp	.655	6	L-58.5 Dia-24	524	Helicopter
	T53-L-7	Turboshaft FT	5(A)	1(C)	1	1,150 shp	.641	6	L-58.5 Dia-24	540	Helicopter
	T55-L-1	Turboshaft FT	7(A)	1(C)	1	1,676 shp	.648	6	L-58.8 Dia-24.25	695	Helicopter
	LTC4G-3	Turboshaft FT	7(A)	1(C)	1	2,535 shp	.590	6	L-62.2 Dia-24.25	795	Helicopter
Pratt & Whitney Aircraft Div., United Aircraft Corp. East Hartford, Conn.	JT12-A6	Turbojet	9	2	8	3,000 lb/t	.95	6.5	L-76 W-21.9	496	Fixed Wing Aircraft
Canadian Pratt & Whitney Aircraft Co. Ltd. Longueuil, Quebec	PT6A-3	Turboprop FT	3(A) 1(C)	1GG 1FT	1 (A)	500 eshp	.69	6	L-52 Dia-18.45	250	Fixed Wing & STOL
	PT6B-3	Turboshaft	3(A) 1(C)	1GG 1FT	1 (A)	500 eshp	.70	6	L-48 Dia-18.45	225	Helicopter & VTOL
Rolls Royce Ltd. Derby, England Via Rolls Royce of Canada Ltd. Montreal, Canada	RDa7/2 Dart	Turbojet	2(C)	3(A)	7	2,020 ehp	.577	5.62	L-97.6 Dia-37.9	1,197	Fixed Wing

Abbreviations: AF—Axial Flow, lb/t—pounds of thrust, C—Centrifugal, eshp—equivalent shaft horsepower, GG—Gas Generator, shp—shaft horsepower, FT—Free Turbine, NA—Not Available

The second problem facing the introduction of gas turbines is increasing competition from the reciprocating engine. There is no doubt that the reciprocating powerplant will be around on lightplanes for many years. Their relatively low cost, low fuel consumption and high reliability guarantee them a place in general aviation for the foreseeable future.

Several technical innovations to improve piston engine performance are either in development or are being marketed by engine manufacturers. These include fuel injection, superchargers of both the geared and turbo varieties and improved propeller gearing. The lightplane manufacturers are planning to put the improved piston engines into existing airframes to boost cruise speed and altitude and cut the performance margin of gas turbine powered designs.

One of the first moves in this direction has been made by Piper with a 60 per cent boost in power for

the Comanche. A Lycoming-powered 400-hp Comanche, now in experimental flight, has a cruise speed of 215 mph compared to 181 mph for the largest model currently offered in that series of aircraft.

The Lycoming Division of Avco Corp. reported considerable progress in the operation and development of both gas turbine and reciprocating engines during 1961. Lycoming's T53 series of gas turbines has amassed more than 100,000 hours of operating experience in both helicopter and turboprop applications. This experience was gained primarily in the Bell HU-1 and the Kaman H-43B helicopters and the Grumman AO-1 Mohawk observation aircraft being flown by the Army. The T53 series is now offered in the 860- to 2535-hp range.

Lycoming also pushed its fuel injection piston engines and introduced several 540-cubic inch engines to the market. They are available in several models, geared, ungeared and geared plus supercharging. The horsepower ranges from 290 to 380. The VO-435 helicopter engine, was offered in a supercharged version developing 260 horsepower up to 15,000 feet. It is being delivered for the new Bell 47G-3B.

Lycoming's reciprocating engine division is convinced that the small conventional engine is here to stay, and continues to develop and improve its nine basic models. The Williamsport, Pa., plant recognizes that the turbine presently offers fewer pounds of engine weight per horsepower produced. It also notes that the turbine requires so much more fuel than its piston counterpart that the fuel-plus-engine weight is actually greater for turbines, offsetting the apparent advantage.

In an area entirely separated from the Lycoming turbine division, the piston engine plant has developed its four-cyclinder 0-360 powerplant from 180 hp to a fuel-injected version producing 205 hp at 2,700 rpm. Likely candidates for the fuel-injected version are the Lake LA-4, Mooney Mark 21, Piper Comanche 180, Beech Travel Air. Further development of the same engine produces 220 hp for the Aerojet SD-2 reconnaissance drone.

"Theoretically," Williamsport's chief engineer C. H. Wiegman told FLYING, "there is nothing to restrict reciprocating engines from matching the turbine's power-to-weight ratios."

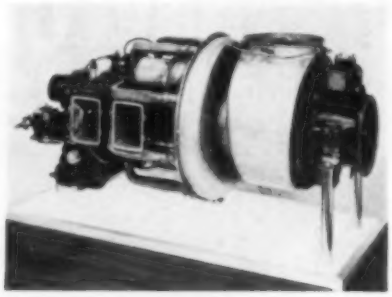
Both sides of the Lycoming engine manufacturing complex feel that there will be a place in powered flight for both types of engines throughout the foreseeable future. Continental Motors Corp., Muskegon, Mich., also manufacturing piston engines for fixed-wing and rotary-wing aircraft, told FLYING that they are expanding their line of powerplants through supercharging, gearing and fuel injection. Though no radical changes, engineering-wise, will be made, there will be engines of varied horsepower to fill some of the gaps which now exists between different models. Fuel injection will receive greater emphasis and higher horsepower engines are now under development.

In the light of experience with turbocharged powerplants, now in use on the Cessna Skyknight, several new models both for fixed-wing aircraft and helicopters will be so equipped. Continental does not expect to build its own turbosuperchargers, but will continue to use the device developed by AiResearch.

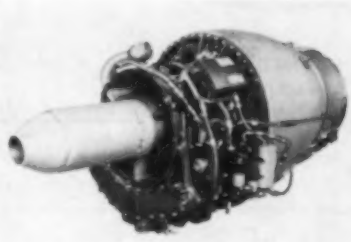
The main effort at Continental Aviation and Engineering Corp. (Detroit, Mich.) during 1961 was on the development of the Model 217 producing 500 shp in the shaft version and 519 as a turboprop. Growth to 600 hp and more is planned for this engine, which is being developed entirely with company funds. In the pure turbojet field Continental is building on its experience, gained in producing more than 2,000 J69 target missile engines. The company policy is to derate these drone engines so that turbine inlet temperatures are reduced and life will go up for applications in manned aircraft. For instance, the model 356-9 producing 1,700 pounds of thrust in the target-missile version has been derated to 1,400 pounds for use in man-carrying airplanes.

The very promising turbofan type of gas turbine engine is under study or development by all of the engines manufacturers. These engines have greater efficiency than pure turbojets, but they apparently won't be available as soon on lightplanes.

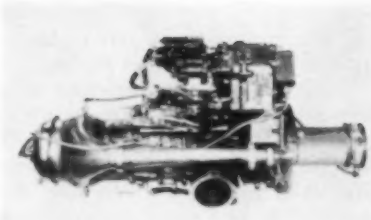
In spite of the cost challenge and increased piston engine competition, two facts (*Continued on page* 135)



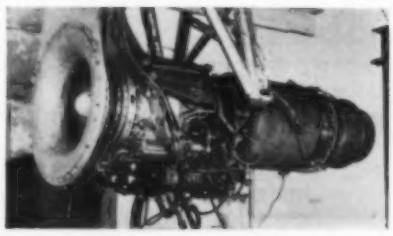
Boeing T60-BO-2



Continental CJ69-102



Allison T63 turboshaft



Pratt & Whitney JT-12

As research divisions work overtime on new lightweight navcom, industry sets itself for the record year of 1962

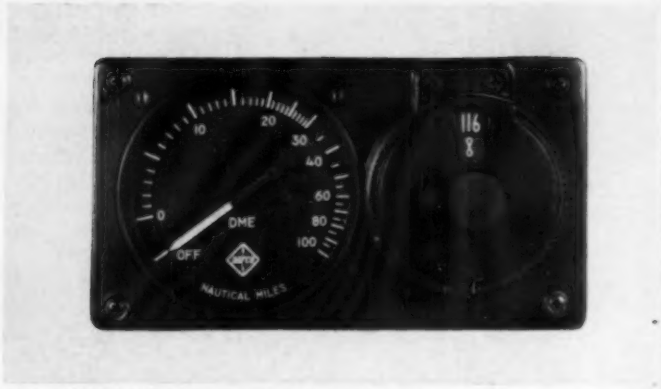
NAVCOM EQUIPMENT

By FLYING STAFF

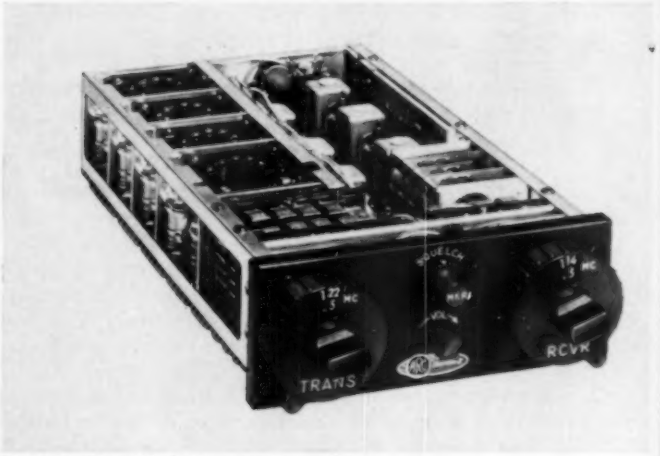
THE SPECTRUM of navigation and communication equipment, after a short rest at the peak of a boom, is beginning to widen once again. Today, navcom equipment that a short while ago was rated as sophisticated even in commercial and military aircraft is being offered to general aviation. DME has made a sudden and strong showing, air traffic control transponders are beginning to appear, complete ILS units are becoming commonplace, and the pictorial navigation display gives a possible taste of a science-fiction future.

With the increasing number of discrete frequencies now in use in high-density areas, a great shift is being made to VHF transceivers built with 50-kilocycle channel spacing in place of the original 100-kc spacing. Civil Air Regulations call for "Two-way radio communication and navigation equipment appropriate to ground facilities . . ." aboard all aircraft. As the ground facilities in high-density areas become more and more dependent of channels available only with many-channel 50-kc equipment, the pilot with fewer communication frequencies may some day find himself guilty, in the eyes of the FAA, of "poor preflight planning." Through its emphasis on 50-kc equipment, the entire navcom industry reflects the concern of general aviation pilots to stay with a growing business.

Though the intriguing new navcom is the eyecatcher

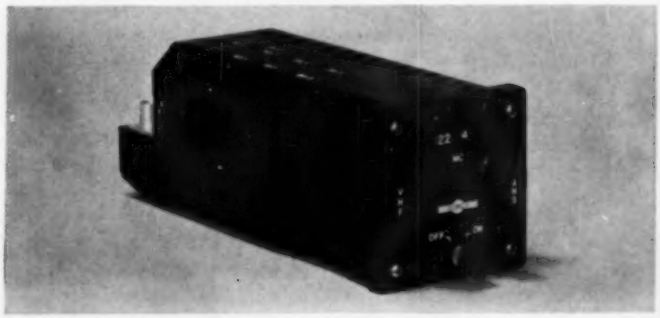


Above: NARCO UDI-2 distance measuring equipment.



Above: The ARC RT-317A navcom transceiver.

Above: Bendix DFA-72 automatic direction finder.



Above: Collins 17L-8A VHF transmitter.

NAVCOM EQUIPMENT

Purpose	Channels	Tuning	Frequency Range	Power Required	Power Output	Weight (lbs.)	Features	Price ($)
Low-altitude Pictorial nav		from VORTAC	VORTAC	26 VAC 28 VDC .6 amp		4	Panel or kneeboard display	4,200
Hi-altitude Pictorial nav		from VORTAC	VORTAC	26 VAC 28 VDC .6 amp		4.5	Slant range computer	4,500
VHF Transceiver	360 (50 kc spacing)	XTAL	118-135.95 mc	14 or 28 VDC	15	19.5		3,622
VHF Receiver	360 (50 kc spacing)	XTAL	118-135.95 mc	28 VDC		6.5		1,500 (appx)
VHF Transceiver	360 (50 kc spacing)	XTAL	118-135.95 mc	14 or 28 VDC	8	6.3		1,555
VHF Transceiver	360 (50 kc spacing)	XTAL	116-135.95 mc	14 or 28 VDC	8	6.3		1,600
VHF Transceiver	360 (50 kc spacing)	XTAL	118-135.95 mc	28 VDC	30	9.5		2,500 (appx)
Glide Slope Receiver	20	Remote	329.3-335.0 mc	14 or 28 VDC		6		1,325
Marker Beacon Receiver	1	Remote	75 mc	14 or 28 VDC		3.7		895
RMI VOR Converter				28 VDC		3.7	Used with ARC Type 15 Series Omni Equip.	1,875
VHF NAV Rec	190	XTAL	108-126.9 mc	14 or 28 VDC		22		3,950
VHF NAVCOM	380 (50 kc spacing) 360	XTAL	108-126.95 mc Revr. 118-139.95 mc Trans.	14 or 28 VDC		13.9		2,350
Course Director				28 VDC		7.7	Electrically driven Gyro	3,527
Course Director				14 or 28 VDC		8.5	Air driven Gyro	2,820
ADF	3 bands	Continuous	190-1750 kc	14 or 28 VDC		20		3,113
ADF	3 bands	Continuous	190-1750 kc	14 or 28 VDC		18.4		2,150
ADF	3 bands	Continuous	190-1750 kc	14 or 28 VDC		14.2		950
VHF NAVCOM Receiver	560 (50 kc spacing)	XTAL	108.0 135.95 mc	27.5 VDC at 0.7 amp		8.4	Transistorized	2,272
VHF NAVCOM Receiver	880 (50 kc spacing)	XTAL	108.0-151.95 mc	27.5 VDC at 0.7 amp		8.4	Extended freq. range	On request
VOR/LOC Receiver		XTAL		27.5 VDC at 0.5 amp		9.21	Transistorized: Vor-chek	On request
VOR/LOC Receiver		XTAL		26 VAC, ¼ amp 27.5 VDC at 0.3 amp		3.9		1,056
VHF Transmitter	560	XTAL	118.0-139.95 mc	27.5 VDC at 6.25 amp	25 watts	15.3	Transistorized	2,584
VHF Transmitter	680	XTAL	118.0-151.95 mc	27.5 VDC at 6.25 amp	20-25 watts	15.9	Extended frequency	On request
ADF		Continuous	190-1750 kc	27.5 VDC at 4.6 amp 26 VAC at 1.2 amp		21.0		3,944
Weather Radar			9375 mc		20 kw	82	150 nm range	11,000
VOR indicator						2.0		On request
VOR indicator						3.25		1,580
RMI						2.5		688
ADF		Continuous	90-1750 kc			4.7	Fixed loop Goniometer System: No moving parts	1,148
Transponder		XTAL	1090 (XMTR) 1030 (RVVR)	115 VAC 27.5 VDC	500 watts	26		3,460
Glideslope Receiver	10 or 20	XTAL	329.3-335 mc	1.2 amp on DC		6.4		1,340
Marker Beacon Receiver	1	Fixed	75 mc	27.5 VDC 13.5 VDC		2.9	Solid state no moving parts	608
ADF		Continuous	90-1800 kc	115 VAC 27.5 VDC		28.2	Flush mount loop antenna	4,767
VOR			108.1-119.9 mc	115 VAC 27.5 VDC		13		2,524
VHF Receiver	880 (50 kc spacing)	XTAL	108.0-151.95 mc	115 VAC 27.5 VDC		10		2,536
VHF Receiver	190	XTAL	108.0-126.9 mc	13.5 VDC 27.5 VDC		3.25		620
VHF Transceiver	360 (50 kc spacing)	XTAL	118.0-135.95 mc	13.5 VDC 27.5 VDC	6 watts min	12.7	Panel mounted	1,995
VHF Transceiver	360 (50 kc spacing)	XTAL	118.0-135.95 mc	13.5 VDC 27.5 VDC	6 watts min	15.3	Panel mounted with remote power supply	2,400
VHF Transmitter	90	XTAL	118.0-126.9 mc	13.5 VDC 27.5 VDC	3 watts	2.25	Remote controlled	400
VHF Transmitter	680 (50 kc spacing)	XTAL	118.0-151.95 mc	27.5 VDC	25 watts	14	Panel mounted	2,808

Abbreviations: XTAL—Crystal, LOC—Localizer, VDC—volts direct current, VAC—volts alternating current, NA—not available, VORTAC—VHF Omni Range/TACAN, OBS—Omni bearing selector, ILS—Instrument landing system, RDF—Radio direction finding

NAVCOM EQUIPMENT

Manufacturer and Model No.	Purpose	Channels	Tuning	Frequency Range	Power Required	Power Output	Weight (lbs.)	Features	Price ($)
[illegible]	DME	126	Electronic	1025-1150 mc	115 VAC 27.5 VDC		35		7,900
[illegible]	WX Radar			9375 mc	NA	20 kw	48.8	Up to 150 nm range	11,000
Canadian Marconi Co. Montreal, Canada									
CMA 101/201	HF Comm	10	XTAL	1.6-13 mc	27.5 VDC 15A max	60 watts	61	Cross band operation	3,120
CMA 123	Doppler Navigation			8,800 mc	115 VAC 28 VDC	500 mw	70	FM/CW	19,850
DARE Inc. Van Nuys, Calif.									
DNC-1	Nav Com XCVR and Indicator	480 (50 kc spacing)	XTAL	108.00-131.95 mc	300 milliamps at 28 VDC		5.0	Panel mount; all transistor; self contained	1,995
[illegible]	ADF		Continuous	190-1750 kc	1.75 amp 28 VDC		19.8 Complete system		2,325 (System)
[illegible]	VHF Transceiver	360 (50 kc spacing)	XTAL	118.00-135.95 mc	5.5 amp 28 VDC	20 watts	21.5	Transistor power supply	2,925
DTX-10	VHF Transmitter	360 (50 kc spacing)	XTAL	118.00-135.95 mc	0.9 amp 28 VDC	10 watts	9.9	Transistor power supply	1,175
[illegible] System	VHF Nav System	360 (50 kc spacing)	XTAL	108.00-135.95 mc	1.9 amp 28 VDC		21.5	Transistor converter & power supply	3,175
[illegible]	Glide Slope Receiver	20	XTAL	329.3-335.0 mc	1.15 amp 28 VDC		7.25	Transistor-ized	850
DM-3	Marker Beacon Receiver	1	XTAL	75 mc	1.0 amp 28 VDC		5.9	3-light plus aural; Transistor power	610
Electronic Devices Corporation Port Clinton, Penna.									
Comm II	HF/VHF Transceiver	10 HF 10 VHF	XTAL	VHF NA 2-15 mc HF	14 or 28 VDC	50 watts	10		NA
20A	HF Transceiver	20	XTAL	2-15 mc	14 or 28 VDC	50 watts	17.4		2,395 complete
[illegible]	HF Transceiver	10	XTAL	2-18 mc	14 or 28 VDC	40-50 watts	14	Direct and remote mtg; very long range	1,065 (appx)
Free Air Products Inc. Portland, Oregon									
[illegible]	Marker Beacon Receiver			75 mc	NA	NA	NA	Self powered	168
King Radio Corp. Olathe, Kansas									
KT-90	VHF Transceiver	90	XTAL	118.0-126.9 mc	14 or 28 VDC	10 watts	8 including power supply		845 (14V) 945 (28V)
KR-40	VOR/LOC Receiver	100	XTAL	108.0-117.9 mc	14 or 28 VDC 14 or 28 VDC		4 including power supply	Self-contained power supply	495 (14V) 555 (28V)
KX-100	VHF Comm & VOR/LOC	90 Comm 100 VOR/LOC	XTAL	108.0-126.9 mc	14 or 28 VDC	10 watts	9 including power supply	Simulta-neous Comm and VOR/LOC	1,195 (14V) 1,295 (28V)
KR-50	VOR/ILS Receiver	100 VOR/LOC 10 glideslope	XTAL glide slope auto-matic tuned	108.0-117.9 mc	14 or 28 VDC		5 including power supply	Automatic volume control	825 (14V) 885 (28V)
KX-110	VHF Comm & VOR/ILS	90 Comm 100 VOR/LOC 10 glideslope	XTAL glide slope auto-matic tuned	108.0-126.9 mc	14 or 28 VDC	10 watts	9 including power supply	Simulta-neous Comm and VOR/LOC; AVC	1,495 (14V) 1,595 (28V)
KR-60	Marker Beacon Receiver				13.75 or 27.5 VDC at 0.25 amp		2 including antenna	Built in ½ lb. glide slope receiver 3-light; Recvr & ant One unit	295
KT-85	VHF Transceiver	360 (50 kc spacing)	XTAL	118.0-135.95 mc	14 or 28 VDC	10 watts	8 including power supply		995 (14V) 1,095 (28V)
KX-220	VHF Comm & VOR/LOC	360 (50 kc spacing) Comm 100 VOR/LOC	XTAL	118.0-135.95 mc 108.0-117.9 mc	14 or 28 VDC	10 watts	9 including power supply	Simulta-neous Comm & VOR/LOC	1,345 (14V) 1,445 (28V)
KI-206	Omni-Localizer/ Converter-indicator				12-15 VDC at .035 amp		2		645
KI-208	Omni-LOC-Glide-slope Converter-indicator				12-15 VDC at 1/15 amp		2.5		995
KX-170	VHF Comm & VOR/ILS	360 (50 kc spacing) Comm 100 VOR/LOC 10 glidescope	XTAL glide-slope auto-matic tuned	118.0-135.95 mc 108.0-117.9 mc	14 or 28 VDC	10 watts	9 including power supply	Simulta-neous Comm and VOR/ILS	1,645 (14V) 1,745 (28V)

Abbreviations: XTAL—Crystal, LOC—Localizer, VDC—volts direct current, VAC—volts alternating current, NA—not available, VORTAC—VHF Omni Range/TACAN, OBS—Omni bearing selector, ILS—Instrument landing system, RDF—Radio direction finding

NAVCOM EQUIPMENT

Manufacturer and Model No.	Purpose	Channels	Tuning	Frequency Range	Power Required	Power Output	Weight (lbs.)	Features	Price ($)
Monterey Electronis Products Monterey, California Partner	VHF Receiver		Continuous	108.0-126.9 mc			1.5	Self-contained battery; transistorized	75
Motorola Aviation Electronics Culver City, California									
M-133	VHF NAVCOM system	90/190 360/560	XTAL	108-126.9 mc 108-135.95 mc	7A. (14 V) XMT 3A. (14 V) RCV	8 watts transmit	from 7.8	Modular Construction Plug-in XTALS	from 1,245
ADF-T-12	ADF		Continuous	190-1750 kc	14 or 28 VDC		10	Transistorized	995
ADF 300	ADF		Continuous	190-1750 kc	28 VDC 115 VAC		20.5		2,785
National Aeronautical Corp. Fort Washington, Pennsylvania Partner									
VC-27A	VHF Transceiver	27 Trans	Continuous	118.1-126.7 mc Trans. 108.0-126.9 mc Rec.	13.5 or 27 VDC 4.4 amp on 13.5V	2 watts	3.2	Whistle Stop Receiver Tuning	505 (12 volt) 520 (24 volt)
MK V	VHF Transceiver	90-190	XTAL	118.0-126.0 mc Trans. 108.0-126.0 mc Rec.	13.5 or 27 VDC 6.5 amp on 13.5V	5 watts	9.5	Completely XTAL controlled	998 (12 volt) 1,042 (24 volt)
MK VI	VOR-ILS Receiver	190	XTAL	108.0-126.9 mc	13.5 or 27 VDC 3.5 amp on 13.5V		6.5	Self contained No power supply req'd	950 (12 volt) 964 (24 volt)
MK 7	VHF Transceiver	360	XTAL	118.0-135.95 mc 50 kc spacing	13.5 or 27 VDC 5.5 amp on 13.5V	6-8 watts	10.5	Fits one standard instrument hole	1,195
MK 10	VHF Transceiver/ Receiver	360 Transceiver 190 Receiver	XTAL	118.0-135.95 mc 50 kc spacing 108.0-126.9 mc	13.5 or 27 VDC 7.5 amp on 13.5V	6-8 watts	12.5	Compact 1½ Package	1,695
DM-2	Distance Measuring Equipment	100	XTAL	1000 mc region paired with Nav Freq 108.0-117.9 mc	13.5 or 27 VDC 8.5 amp on 13.5V		14 with shockmount	Light weight DME	2,250
Aerocommander VHT-5	VHF NAVCOM Transceiver	12 XMIT	Continuous	121.0-123.0 mc	4.5 amp on 13.5V	2 watts	7.8	One package power supply included	575
Dominator VH-5A	VHF NAVCOM Transceiver	27 XMIT	Continuous Whistle Stop	Lo Band 118.0-123.0 Hi Band 121.5-126.9 108.0-126.9 Rec	13.5 or 27 VDC 5 amp on 13.5V	3-5 watts	13.9	Communications VOR/ILS includes Marker Beacon REC	1,099 (12 volt) 1,160 (24 volt)
LF-5	LF Receiver		Continuous	200-400 kc 550-1500 kc	0.6 amp on 13.5V		2.1	Small size includes Broadcast Band	109
MBT	Marker Beacon Receiver			75 mc	13.5 or 27 VDC 5 MA on 13.5V		18 oz	3-light, may be remote mounted MBT-R	230 250 (MBTR)
GS-5	Glide Slope Receiver	10 or 20	XTAL	329.3-335.0 mc	13.5 or 27 VDC on 13.5V		6.75 with shockmount		695
ADF-60	Automatic Direction Finder	2 Bands	Continuous	190-560 kc 540-1620 kc	13.5 or 27 VDC on 13.5V		7.75 with loop	One moving part	895
CI-5	LOC/VOR Indicator				1.2 amp on 13.5 VDC		5.5 with shockmount	For use with MK 5, MK 10 VC-27A; with glide-slope	699
CI-5A	LOC/VOR Indicator				1.2 amp on 13.5 VDC		5.5 with shockmount	For use with MK 5, MK 10 VC-27A	499
Sierra Tech, Inc. Santa Barbara, California									
SVHF-1A/ SVHF-1AT	VHF Comm	23	Continuous	XMIT 100-150 mc RCV 108-130 mc	XMIT-5 amp RCV-3½ amp	2 watts	3½	Built-in Intercom	385
Sierra Omni	Connects to any standard VHF Receiver to provide Omni navigation				½ amp		1	Transistorized Self-contained	385
TT-23SA	VHF Comm	23	Continuous RCVR	XMIT 100-150 mc RCV 108-130 mc	XMIT-6 amp RCV-4 amp	2 watts	3½	2 XTALS-Ant. & power supply	229

Abbreviations: XTAL—Crystal, LOC—Localizer, VDC—volts direct current, VAC—volts alternating current, NA—not available, VORTAC—VHF Omni Range/TACAN, OBS—Omni bearing selector, ILS—Instrument landing system, RDF—Radio direction finding

NAVCOM EQUIPMENT

Manufacturer and Model No.	Purpose	Channels	Tuning	Frequency Range	Power Required	Power Output	Weight (lbs.)	Features	Price ($)
EB-1	VHF Comm	23	Continuous RCVR	XMIT 100-150 mc RCV 108-130 mc	XMIT-5 amp RCV-3½ amp	2 watts	3½	Specially constructed for rotary wing aireraft	575
TR-102/CAP	VHF Comm w/CAP freq.	46	XTAL/ Continuous	108-130 mc 142-148 mc	6 amp	2 watts	5	Complete with power supply antenna, all cables	330
Radio Corporation of America Los Angeles, California AVR-30	Marker Beacon Receiver	1	Fixed	75 mc	.3 amp 28 VDC		4	3-light; Transistor-ized	780
AVQ-40B	Transponder	2	Fixed	1090 mc XMIT 1030 mc RCV	150 VA 115 VAC	500 watts	23		3,950
AVQ-55	Weather Radar	1	Fixed	9375 mc	NA	NA	40	Transistor-ized; 90 nm range	9,000 (appx)
Skycrafters, Inc. Long Beach, California Superphone AL2T9/AMR4	VHF Transceiver	24 XMIT	Continuous Whistle Stop	108 to 128 mc	3.5 A @ 13.75V 2 A @ 27.5V	1.5 watts	5	Transistor-ized Pwr. supply	317
Super-Nav I Omni	VOR Indicator				0.6 amp @ 13.75 VDC 12 Ma. @ 160V		2		200
TRV-126A Multiphone	VHF Transceiver	6		3 mc spread (max) 118.1-112-128 (REC)	Self-Cont. Dry Battery or 14/28 VDC 115 VAC	1 watt	10.5 or 12	Portable for Light Planes, Gliders, copters	411 518
TRV-122 Multiphone	VHF Transceiver	1 or 2	XTAL	112-132 mc	Self-Cont. Dry Battery or 14/28 VDC 115 VAC	1 watt	10.5 or 12		313 420
ARS Birddog RDF-2C	RDF	2 Bands	Continuous	200-450 kc 550-1600 kc	12 VDC 3 amp		10		295
RMT-5 Power Booster	VHF Transmitter Booster		Variable	118-128 mc	3.5 amp @ 13.75 VDC	3-5 watt	2	Boosts Pwr. out-put of any 0.5-2W. VHF Transmitter to 5W.	150
SunAir Electronics, Inc Fort Lauderdale, Fla. Model T-5-DA	HF Comm	5-Rec. 5-Trans.	XTAL	2-18 mc	14-28 VDC	35 watts	10	XTAL Contr. self-Contd. transistor pwr. supply	895
Model T-10-D	HF Comm	10-Rec. 10-Trans.	XTAL	2-18 mc	14-28 VDC	45 watts	13	XTAL Contr. self-Contd. transistor pwr. supply	1,050
Model T-22-B	HF Comm	22-Rec. 22-Trans.	XTAL	2-18 mc	14-28 VDC	45 watts	15	XTAL Contr. self-Contd. transistor pwr. supply	1,895
Model T-22-RA	HF Comm	22-Rec. 22-Trans.		2-18 mc	28 VDC	45 watts	15	XTAL Contr. self-Contd. transistor pwr. supply	2,395
Wilcox Electric Co. Kansas City, Missouri 700B	Glideslope Receiver	10	Electro-Mechanical Diode Switch	329.3-335.0 mc	2.2 amp 27.5 VDC		7	Transistor-ized	1,135
800A	Glideslope Receiver	10 or 20		329.3-335.0 mc	6.9 watts 27.5 VDC		5	Solid State (No moving parts)	1,000
861C	ADF	4 Bands	Continuous	90-1750 kc	0.6 amp (115 VAC) 1.5 amp (27.5 VDC)	100 MW	15		1,965
702	Marker Beacon Receiver	1	XTAL	75 mc	2.1 amp (27.5 VDC)	100 MW	6	3-light	680
700	VHF Receiver	360 (50 kc spacing)	XTAL	118-136 mc	3.35 amp (27.5 VDC) 0.1 amp (250 VDC)	100 MW	9.5		2,140 (less pwr. sup.)
700	VOR/LOC Receiver	360 (50 kc spacing)	XTAL	108-118 mc	3.0 amp (27.5 VDC) 0.2 amp (250 VDC)	100 MW	22 (Man) 27 (Auto)	Rec. oper-ates in Comm Freq.	2,495 (Man) 3,430 (Auto) (less pwr. sup.)

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NAVCOM EQUIPMENT

Manufacturer and Model No.	Purpose	Channels	Tuning	Frequency Range	Power Required	Power Output	Weight (lbs.)	Features	Price ($)
707	VHF Transmitter	360 (50 kc Spacing	XTAL	118-136 mc	2.5 amp (27.5 VDC) 0.12 amp (250 VDC)	30 watts	12.5		2,140 (less pwr. sup.)
714C-1 714C-2	Transponder	1	XTAL	1030 mc Rec. 1090 mc Xmtr	1.7 amp (115 VAC) 2.0 amp (27.5 VDC)	500 watts	25	3-pulse SLS 2- & 3-pulse SLS	3,496 3,896
730	ADF	4 Bands	Continuous	90-1750 kc	0.9 amp (115 VAC) 1.5 amp (27.5 VDC)	100 MW	15	Electric Tuned	2,500
814	Transponder	1	XTAL	1030 mc Rec 1090 mc Xmtr	40 watts (27.5 VDC)	500 watts	10		1,975 (System)
882	DME	126	XTAL	962-1213 mc	150 VA (115 VAC) 0.5 amp (27.5 VDC)	1,000 watts	30	Transistor-ized	8,000 (System)
890	Weather Radar		Fixed	9375 mc	300 VA (115 VAC) 5 watts (27.5 VDC)	15 kw	57 (24") 45 (12")	Transistor-ized	9,000 (System)

Abbreviations: XTAL—Crystal, LOC—Localizer, VDC—volts direct current, VAC—volts alternating current, NA—not available, VORTAC—VHF Omni Range/TACAN, OBS—Omni bearing selector, ILS—Instrument landing system, RDF—Radio direction finding

and the fastest-growing of all the field, the old standbys, the medium-price conventional VOR and VHF communications, are still doing well throughout the field. Narco's Omnigator, a combination VOR and VHF communications system, sold its 20,000th unit in 1960, and the company's higher-priced Superhomer sold its 20,000th unit in the first half of 1961.

A key word for 1961 has been availability. General aviation airplanes can now be equipped with transponders, distance measuring equipment, weather radar, pictorial navigation units—the latest in the field of navcom. Though it is an expensive proposition to have all this equipment on one aircraft, it is today available, where a year ago some of it could not have been had at any price.

Solid-state electronics, printed circuits, and the transistor are key ingredients in the new wave of airborne navcom equipment. Transistors, for instance, are not as vulnerable to vibration as the vacuum tubes they replace. They produce less heat and require less voltage for operation. Several navcom units are completely transistorized, and some, as glide slope receivers, contain no moving parts at all.

With the new simplicity comes new reliability. One manufacturer's standard glide slope receiver had an average "fail-time" of 1,400 hours of operation. The company's new solid-state receiver, requiring no lubrication or cleaning, has a fail-time of 4,500 hours.

As navcom equipment becomes smaller and lighter, it will fit more airplanes. With airlines buying larger airplanes and fewer of them, "more airplanes," to manufacturers, means the vast and growing market of general aviation.

Aircraft Radio Corporation (FLYING June '61) thinks in terms of systems. Its Starflite I system is first quality, remoted, and is offered as an integrated panel unit for light and heavy twins. The equipment, which the company calls its "bread and butter," includes all navcom and a course director, sells for $21,500. Today, 60 per cent of all Grumman Gulfstreams are equipped with Starflite I electronics, as are 80 per cent of all Aero Commanders. The Starflite II system is panel mounted and designed for light twins and heavier four-place single-engine airplanes. It contains complete IFR navcom, sells for about $8,700. (*Continued on page* 124)

Wilcox model 814 transponder.

DARE equipment in display setting.

ARC's ILS glide slope and localizer indicator.

Support equipment makes operation of an airplane a smooth, efficient business. A look at the new hardware

SUPPORT EQUIPMENT

By FLYING STAFF

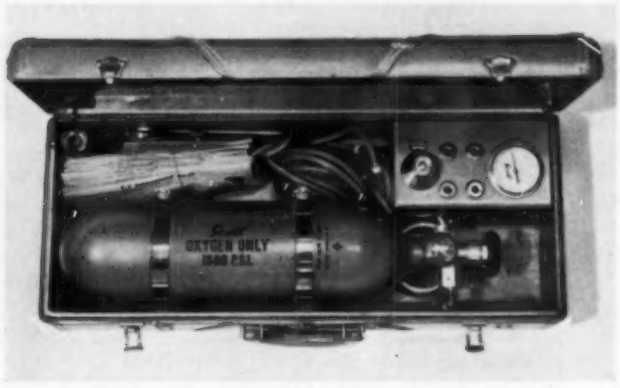
THE MARKET in support equipment is always ready for a new approach to the old problems. Throughout the field manufacturers are learning that the pilot needs and wants additional equipment which will increase the utility of his airplane, upgrade it to modern standards, and ease his task of navigation and communication.

Today there are hosts of organizations with new equipment to aid the pilot and his airplane. Flight planning accessories are offered to replace the string over the wall map, and benefits of laboratory advances are being reflected in high-quality low-cost accessories and equipment designed to improve aircraft performance.

New support equipment bursts upon general aviation from many sources; from established support equipment companies, from outside industries that market only a few pieces of aviation equipment, from individuals and small companies that measure their future on the success or failure of a single idea. The market of general aviation is so vast, however, that it can support a tremendous amount of competition, and the range of the market is such that less-than-a-dollar gadgets have just as much a home as multi-thousand-dollar aids to executive pilots.

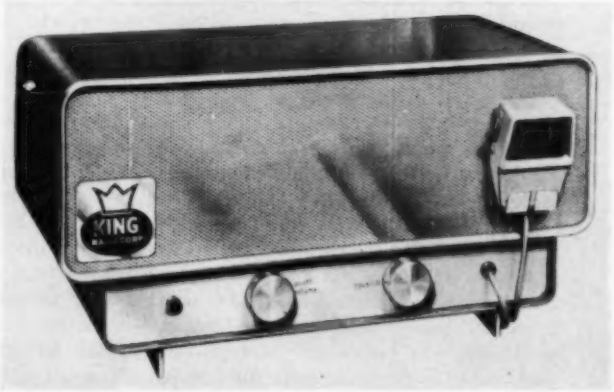
One of the most fertile fields of support equipment lies with individual pilot improvement at all levels.

Above: Edo floats equip Cessna 185.



Above: Scott Aviox portable oxygen system.

Above: Brittain tiptanks on Piper Comanche.



Above: King Radio Corporation's KG-300.

Aero Progress, Inc., of Los Angeles, for instance, has made recordings of the voices of experienced pilots going about their familiar task of flying back and forth across the country, for the benefit of pilots to whom the task is not so familiar. The long-playing 12-inch records are the recorded-in-flight, hear-it-as-it-is type; not slanted to bring a student past an examination, but to enlarge the understanding of all-level pilots without the necessity of their flying the route or procedures in person.

The two-year-old company recently has completed a New York-to-Los Angeles IFR flight recording to complement its Los Angeles-to-New York VFR package, which sells for $15, including Jeppesen charts and a trip work book for students of the cross-country. In planning is an oceanic flight to record procedures involved in a Los Angeles-Oakland-Tokyo trip. Aero Progress has received "excellent response" to its stable of eight training records, and feels that it is just beginning to tap the potential of the field.

For student pilots, Sanderson Films, Inc., of Wichita, Kansas, produces a seven-section film strip/phonograph ground study course (FLYING, February 1961). The $495 package includes phonograph and projector, 1,200 color slides, 15 hours of recorded narration to accompany the film, and study booklets that expand on voice and pictures. Subjects covered are preflight facts, meteorology, navigation and radio navigation, and Civil Air Regulations.

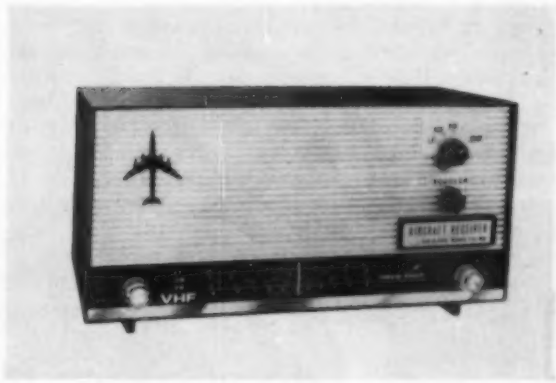
A more advanced form of increasing pilot proficiency is found in the Link 60-series general aviation simulator. This Link, introduced in late 1960 (FLYING, October 1960), has basic performance to 8,800 feet and 220 mph, and is available in Electronic and Radio versions. The $30,000 system is substantially less expensive than airline simulators, and at this writing Continental Air Lines has purchased three for radio procedure training of its pilots. Modification kits are available to increase the capabilities of the trainer to simulate performance of any general aviation aircraft. Several corporations are now seriously considering joint ownership of an L-150 advanced twin-engine simulator, to be shared by their pilots.

Jeppesen and Company, which services the Army and all U.S. airlines with computers and complete flight information publications, says that its general aviation subscribers outnumber customers of either category.

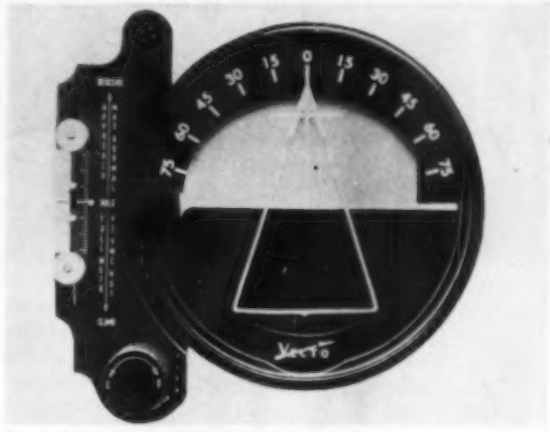
The Denver, Colo. company, aware of the unwieldy amount of charts needed for instrument flying is now at work on a "revolutionary presentation" of information that will substantially reduce paperwork in the cockpit. Also in development by Jeppesen is a set of special radio aid charts for VFR pilots, to be introduced in 1962.

Air navigation equipment, books and supplies are the forte of the Weems Systems of Navigation, Inc., Annapolis, Maryland. Manufacturers of the well-known E-6B computor, now being produced in a pocket-size version, Weems has recently introduced a Mark 2W plotter that features reversible scales, legible from either side. In operation since 1928, the company has introduced a set of proportional dividers that automatically measure time between points on a chart.

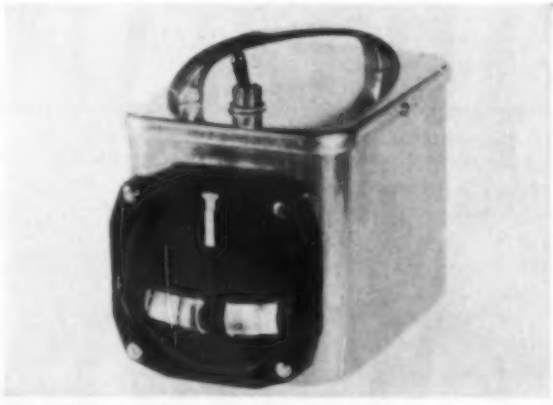
A great amount of support equipment can be labelled as utility-increasing accessories. (*Continued on page* 144)



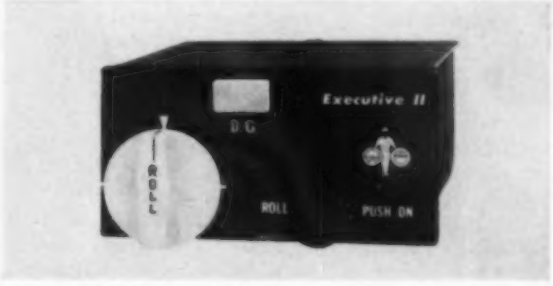
Above: Nova-Tech four-band home receiver.



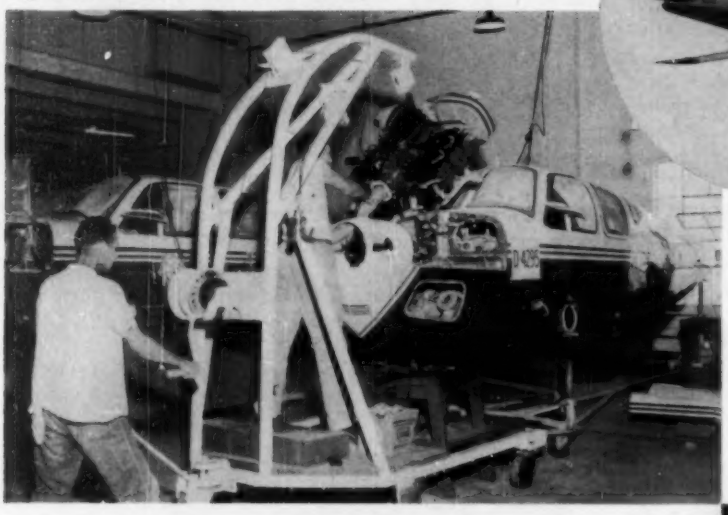
Above: Vecto Attitude Reference Indicator.



Above: Waltham "Lifesaver" package turn needle.



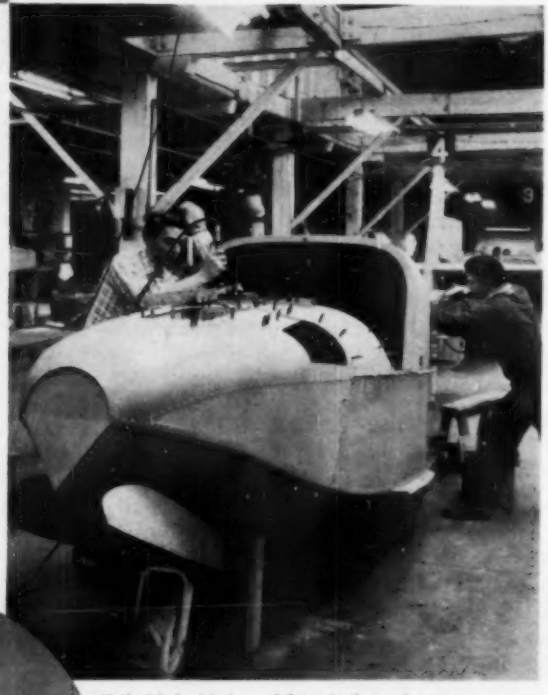
Above: Mitchell single-axis autopilot.



Engine mated to a Beechcraft Bonanza fuselage.

A special report on the key factors that determine the price of an aircraft—from design to final production

WHY AIRCRAFT COST MONEY



Hull of Lake LA-4 amphibian in the early stages.

By ROBERT I. STANFIELD

What goes into the making of an aircraft? Modern aircraft—both fixed-wing and rotary wing—cost money. They are high dollar-volume items. They have prompted queries such as the following, voiced by a university professor during a discussion covering the economics of aviation: "I don't know a thing about aircraft except that they cost so much." Of course there's more to the story than meets the eye, as the professor soon found out—to his satisfaction.

In this special FLYING report, this magazine presents the key factors—from design to ultimate production—involved in the basic cost structure of today's aircraft.

Reflected is the cooperation/coordination of executives and personnel—the engineers, and the people in the manufacturing, sales, service, quality-control and industrial-engineering departments—visited during on-the-spot coverage of plants in the northeast, midwest and southwest.

The economics of this article can be roughly applied to all aircraft manufactured in the United States. For specifics, however, we will cover the production of the following three aircraft:

The single-engine Lake LA-4 amphibian ($26,580), manufactured by Lake Aircraft Corp. at Sanford, Maine; the single-engine Bonanza ($26,500), turned out at Wichita, Kansas by Beech Aircraft Corp., and the utility helicopter Model 47G-2A Trooper ($39,950), produced by Bell Helicopter Co. at Fort Worth, Texas.

Varied reasons hold the aircraft as a high dollar-volume item. There is hand work involved in its construction, plus the amount of conformity to the amount of inspections required. Other factors include Federal regulation and low volume production which not only influences the amount of hand work but also increases the unit cost of purchased parts and materials.

Contrast the aircraft and the automobile. The car is "land supported"; its design, fabrication and performance are not governed by law. The aircraft, because of its environment, must meet government requirements established for the protection of the user and the public at large.

Federally regulated specifications control design engineering, method of manufacture, mechanical functions, flight operating limits, airworthiness and maintenance. Moreover, to achieve mobility, the aircraft requires more systems and accessories, such as propeller, etc., all subject to regulation. And to ensure that it will withstand environmental loads and forces, aircraft must meet minimum safety standards for structural strength and stress.

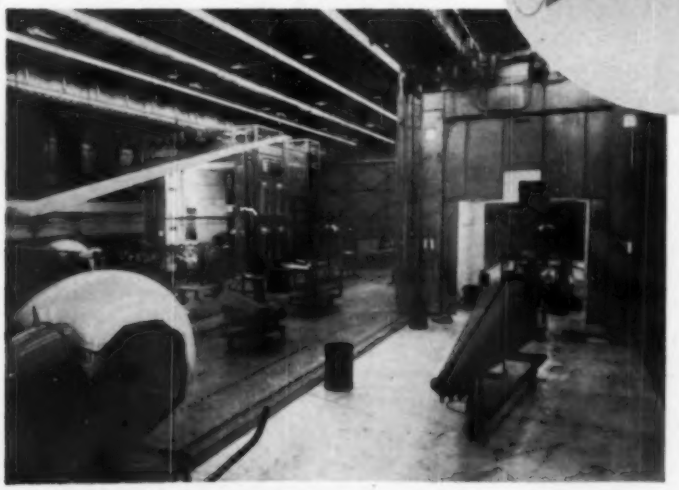
It takes many different skills to produce a single machine, just as it does to produce a large number of machines. Thus, a manufacturer producing a small number of complex units must, by necessity, employ as many skilled workers as the manufacturer producing a large number of units. In addition, he must purchase his raw materials and vendor items in smaller quantities and pay higher costs.

These basic economic facts are reflected in again contrasting the aircraft and the automobile. Auto manufacturers with their annual output of some six million units have a distinct advantage over aircraft makers with their production of less than 8,000 units a year. Despite this 750-to-one production advantage for auto manufacturers, aircraft manufacturers have been able to reduce their costs to within $14 of the cost-per-pound ratio in the auto industry.

This cost-per-pound ratio comes into sharper focus in comparing weight and price categories. Let's estimate that three million of the auto industry's total unit production are cars having an average weight of 3,700 pounds and an average price of $4,000—double the average empty weight and less than one-sixth the average price of the 1,500 Bonanza-class planes produced in a year. Here the auto makers have a 2,000-to-one production advantage.

Even with this 2,000-to-one advantage, the cost of this class airplane is still within $14 of the cost-per-pound ratio for all autos in the $4,000 price category. This represents a high level of production efficiency for the aircraft manufacturers, particularly considering the close tolerances and precision craftsmanship involved.

Assembly line for Bell helicopters at Fort Worth.



It takes anywhere from 24 to 36 months to bring a new product from drawing board to marketable hardware. Initial development costs of a new business aircraft under 12,500 pounds gross weight run anywhere from $2 million to $5 million or more, depending on the model. Development costs of yearly design changes and improvements average $100,000 or more for single-engine aircraft. This, of course, will influence price.

Let's get to some specifics involving the Beech, Lake and Bell aircraft.

Bonanzas delivered over the past 14 years amounted to 6,700 units; prices ran from $6,500 in 1946 to $8,000 in 1950 to $26,500 today. Reasons: increased manpower

costs, new equipment installed due to FAA regulations or requirements (there is now one FAA employee for every 1.7 aircraft, which reflects in cost of customer service as well as plant costs), increased materials and equipment costs.

Manpower cost of the $25,000 airplane is 20 per cent or $5,000, John Allen, manager of production development for Beech, told FLYING. Overhead including cost of sales is 25 per cent. Some $300 in development costs per plane is actually $600 when it reaches the customer; to the $300 must be added Beech overhead, dealer and distributor profit. The present airplane selling for $25,000 also has about $12,000 in raw material costs, including purchased items. Engine costs (list is $5,000) do not include fuel pumps, exhaust manifolds, heaters, etc. Propellers list for $600.

The Bonanza has about 17,700 parts, including details, assemblies and purchased items, but excluding rivets. Purchased parts and items account for about 40 per cent of the total. The number of vendors or subcontractors will vary; there are about 4,000 sources of supply on Beech's approved list. Employes of the large company number 4,500.

The manufacture of one Bonanza requires over 10,200 individual inspections—6,990 on detail parts, 1,300 on sub-assemblies, 630 on the purchased parts and 1,280 on assembly, flight and certification. The number of inspections on detail parts very from a minimum of two up to 37 different inspections on complex parts, such as the propeller hub housing.

Total inspections also include such special inspections as X-ray of 25 aluminum and magnesium parts to determine internal qualities; magnetic checks of over 400 steel parts to determine surface and internal condition. A fluorescent penetrant (ultra-violet light) is used on 68 castings and forgings to detect microscopic surface conditions. More than 100 functional tests are conducted on systems and operating components.

Also, flight tests of approximately two hours of flying time and 25 hours of labor are performed on each Bonanza to assure proper function and performance.

Inspection activity support requires the specialized services of chemists, metallurgists, X-ray technicians, aeronautical and electronic engineers, metrologists, statisticians, quality-control engineers, etc. Government regulations require a Production Inspection Record file in excess of 125 pages on each airplane, plus shop and inspection station records amounting to thousands.

The above "in house" activities do not include the thousands of inspections performed by the suppliers of purchased equipment, including radio, nav/com and accessory equipment. The ratio of indirect to direct labor in aircraft manufacture stands at around .6 to one. Additional personnel required to support manufacturing personnel—including engineering sales and administrative workers—increases the ratio to about one to one.

Lake Aircraft, for its LA-4, has 217 outside suppliers. From these are purchased, (including fabrications) some 1,261 parts, some of which are complete assemblies. Initial tooling cost of the small amphibian was $69,136.50; additional tooling has since been accomplished. Lake will spend and have budgeted $120,000 in the next two years for tooling, FLYING was told.

At the Sanford, Maine, plant, there are eight full-time inspectors. Three test pilots fly new aircraft a minimum of 10 hours total time prior to final acceptance. The development cost of the LA-4 was a low $872,500; low because much of the initial development was done back in the mid-forties. The same airplane, developed from scratch today, would entail a minimum figure of $1,750,000, states president John F. Strayer.

For its amphibian, Lake fabricates 2,232 parts. The cost of the smallest part (washers and rivets are bought by the pound) is less than one cent; the most expensive part, the engine, lists for over $2,000.

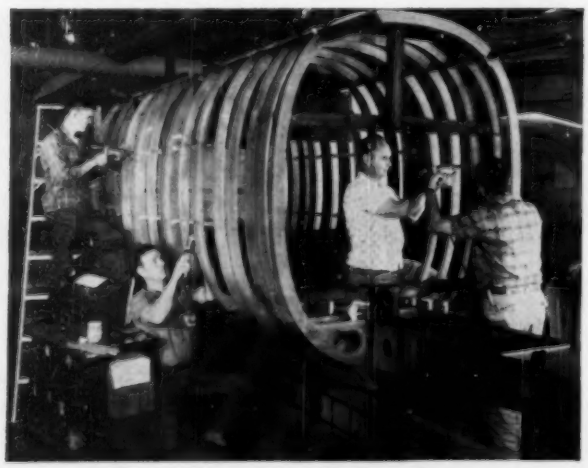
Inventory of the average aircraft company normally runs about three times the monthly dollar volume of the business. If an aircraft company is selling $250,000 worth of aircraft per month, its inventory would run around $750,000, a three to one ratio to monthly sales.

Lake employes 102 people in direct labor and 35 in indirect. Present number of man-hours per aircraft is approximately 3,000; with additional tooling and increased production this would be reduced. For every dollar of direct labor there are about 1.5 dollars of indirect. Also, from the standpoint of total advertising and selling budgets, there is a variance with companies in the industry; usually from 2.5 per cent to 5 per cent of the total selling price (of the gross income of the manufacturer).

For its helicopters, Bell, pointing to the initial development of a new-type rotorcraft through its complete cycle to approval for production, notes that engineering costs are more than 50 per cent of total development costs. Cost breakdown for a typical production project shows 45 per cent to design, 38 per cent to laboratory tests and 17 per cent to flight test.

A standard test program would involve fatigue testing of about 12 samples each of the dynamic helicopter components (rotor blades, hubs, grip, etc.) for several million cycles each. Also included would be about 500 hours of tie-down running, 500 hours of rotor whirl testing, 1,000 hours of rotor drive system testing and 150 hours of experimental flight. Company estimates that three to five per cent of the cost of a production model is attributable to tooling cost.

Factor influencing helicopter tooling costs is the relatively small number of helicopters to be produced, and the few months of effective tool usage before changes occur. Bell has built some (*Continued on page* 139)



The fuselage of the new Jet Commander Model 1121 begins to take form.

THE AIRMAN'S WORLD

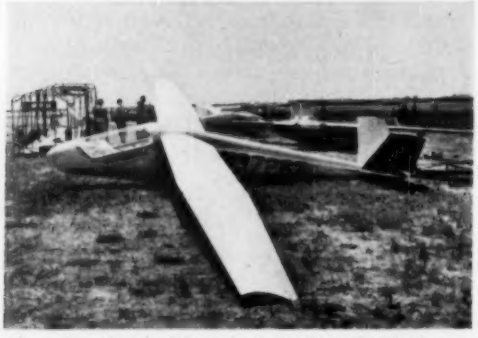
Gone are the barriers,
Mountain and plain
Taxing the race of us
Heartache and pain;
Gone are the centuries
Fettered in dust,
Dark with restrainings and
Breeding mistrust;
Come are the knowledges
Like to a dawn
Lighting the path of man
Upward and on,
Lifting the hopes of man
Higher to find
Secrets long hidden from
All of his kind;
Wings have my feet to fly,
Wings have my heart
Seeking the whole of which
I am a part;
Coursing the continents,
Spanning the sea,
God, what a gift of life
Falleth to me!
God, what a boon to live
Free in my will
To seek Thee uncloistered
By yesterday's hill.

GILL ROBB WILSON

National Soaring Champion, Andrew J. Smith (inset photo) won the meet flying a German Lo-150 sailplane, shown above while in tow at Wichita, Kan.

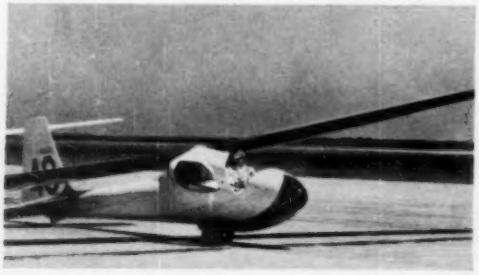
Task of the day was determined during daily pilots meetings. Man in dark glasses is Paul Bikle, holder of world's sailplane altitude record of 46,200 feet.

Slickest sailplane at the Nationals was John Ryan's Sisu.



Above: Prue Standard flown by Paul Bikle to fourth place.

Below: Wm. Ivans, second place winner, in the Skylark 3D.



Weather conditions which did not live up to expectations made this one of the most challenging meets in U.S. soaring history

28TH NATIONAL SOARING CONTEST

By WILLIAM P. STEWART

THE MIDWESTERN area from Nebraska in the north to the Texas and Oklahoma panhandles in the south breeds and spawns some of the most violent thunderstorms encountered by man. They are the result of the hot sun beating on dry prairie land which, in turn, generates strong convection and, consequently, excellent soaring conditions.

When it was first announced that Wichita, Kan. was selected as the site for the 28th National Soaring Contest, most soaring pilots expected that flight performances during the meet would be in the record category. Unfortunately, though, the weather situation proved disappointing. During the 10 days of the event, from August 1 through August 10, only five were officially scored. Weather provided marginal soaring which caused all contestants to exercise their ability and ingenuity to the utmost.

Outstanding flights on no-contest days were made by William Coverdale of Waynesville, Ohio and William Ivans of San Diego, Calif. Coverdale flew 88 miles under alto cumulus cloud cover to Enid, Okla. in his German built Ka-8 and scored only admiration from his fellow contestants but no points. He promptly followed this flight by another one on a no-contest day by flying 48 miles to Anthony, Kan. with return to Wichita, continuing to Viola, Kan. for a total of 96 miles. Inasmuch as scoring required that five contestants complete flights of 100 kilometers (62.14 miles) each, Coverdale's only reward was the title of "Three Leaf Cloverdale" bestowed on him by his fellow participants.

Sunday, August 6th, finally provided the booming conditions everybody expected. The task was set as a goal flight to Greensburg, Kan. with return to Wichita and from there free distance at pilot's discretion. John Ryan of Scottsdale, Ariz. flew his sleek Sisu sailplane 333 miles for the longest flight in this year's Nationals. The next longest flights were made by Andrew J. Smith of Tecumseh, Mich. in a German-built LO-150 and Bernard Carris of Big Flats, N.Y. in the RJ-5, each covered a distance of 270 miles. The following day's task was declared as free distance, with pilots choosing their goals. Thirty of the 33 contestants promptly departed Kansas and flew north to Nebraska for a combined distance of 7,692 miles.

At the end of four contest days only 200 points separated the first four pilots: National Soaring Champion Richard Schreder of Toledo, Ohio flying his new Air Mate HP-10, John Ryan in the Sisu, Andrew J. Smith in the LO-150 and Rudolph Alleman of Richland, Wash. at the controls of a Schleicher Ka-6CR. This was indicative of the highly competitive skill demonstrated by most of the entrants, wherein an error or omission could be disastrous as far as point standing was concerned. On the fifth and last day, Andrew J. Smith flew his LO-150 faultlessly fulfilling the task of the day, an 81-mile speed dash to Salinas, Kan., in the fastest time, averaging 42.19 mph and thereby winning the title of U.S. Soaring Champion. Schreder, who until then was top man, did not reach the goal and dropped to ninth place. Second place went to William Ivans and third to Rudolph Alleman.

Twenty different types of sailplanes, predominantly of light wing loading, were flown in this year's Nationals. Most of them were well known and frequent participants. Three completely new designs made their first appearance. These were Richard Schreder's Air Mate HP-10, a very promising aircraft featuring metal honeycomb wing construction and extremely smooth finish. The HP-10 may be soon available on the market in kit and ready-built form. Richard Johnson's Adastra, flown by him in last year's World Soaring Championships in Germany (FLYING Sept. 1960) considerably modified since then and Irving Prue's Prue Standard, believed to be of particular merit and interest as it was flown by Paul Bikle, president of the Soaring Society of America and holder of World Altitude record for sailplanes (46,200 feet). Prue, who is in Lockheed Aircraft's Test Division, hopes to market the sailplane provided 30 firm orders can be obtained, under which circumstances that price for a fully certificated Standard will be around $3,700.

The Kansas Soaring Association, sponsors of the 28th National Soaring Contest, hosted an interesting and sometimes trying (because of weather) competition which was well managed and administered. Aero tows were performed efficiently and expeditiously, competitors were launched every two minutes by Cessna 172s, 175s and 182s provided through the courtesy of Cessna Aircraft Co. Beech Debonairs, furnished by Beech Aircraft Corp., flew official observers to locations over which the sailplanes (*Continued on page* 158)

Schreder's Air Mate HP-10, N6511D, in lineup; note constant chord wing.

AVIATION

Petroleum's young giant, kerosene fuel, brings promise and problems as it is nurtured by today's jet age

CLEAR AND BRIGHT is the battle cry and probably a capsule forecast of the future of petroleum turbine fuels for aircraft. It represents a revolution and a challenge. The revolution was the elbowing aside of aviation gasoline as the primary fuel for the world's airplanes by kerosene and kerosene blends. The challenge is in conquering the problems accompanying use of the new jet fuels.

Despite years of development and refinement as an efficient and economic means of powering the piston engine, avgas lost out to kerosene when it came to selecting fuels for the turbine engine.

Avgas is quicker to ignite (because of its lower flash point) and therefore more of a safety hazard. In addition it is more likely to boil away at jet altitudes. It will yield less heat for volume in burning. And on top of that, it is considerably more expensive—especially in terms of the exaggerated fuel-gulping capacity of the new turbine engines.

So the kerosene fuels came on with a rush, and zoomed up from insignificant volume in 1950 to where consumption passed that of avgas in 1955 in the Western World. And with the dramatic growth of turbine-powered fleets in all fields of air travel—airlines, military and executive, the volume continues to rise strongly.

But in spite of the advantages of the kerosene fuels, the switch from avgas represented a give-and-take proposition in several ways.

One of these concerns the deceptively prosaic matter of cleanliness. Kerosene is denser and more viscous than avgas and therefore more likely to hold and retain in suspension impurities such as fine particles of rust, water, or other foreign material. These particles can take five to ten times as long to settle in kerosene as in gasoline.

At the same time, the turbine engine has the appetite of a whale. The fuel feed and pumping systems must work harder. Tolerances in pumps and fuel control mechanisms are closer and fuel pressures higher. Fine contaminants may block up fuel supply systems and erode critical parts of engine and fuel control system. Also, water freezing at high altitudes may plug fuel screens.

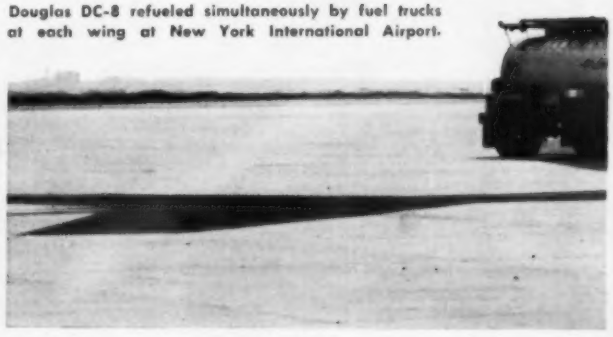
As a result, the tolerable contamination levels for turbo fuels are much lower than ever considered necessary for avgas. Hence the absolute necessity of fuel that is, in the vernacular of the industry, "clear and bright."

The problem of cleanliness has sent engineers scurrying to drafting board and laboratory in the design of filters and methods of insuring maximum settling time—and transforming all of these factors into practical methods that can be applied to the flight line.

Fuel companies attempt to provide cleanliness control in a continuous step-by-step fashion as fuel is transferred from the refinery to the airplane.

In some cases two or more operating tanks are provided for each grade of turbo fuel at the airport. This allows one tank to be receiving or settling fuel while current needs are satisfied from tanks in which the fuel has already been settled.

Also, in a typical system, fuel is passed through filter/separators at least three times to take out contaminants and coalesce and (*Continued on page* 156)

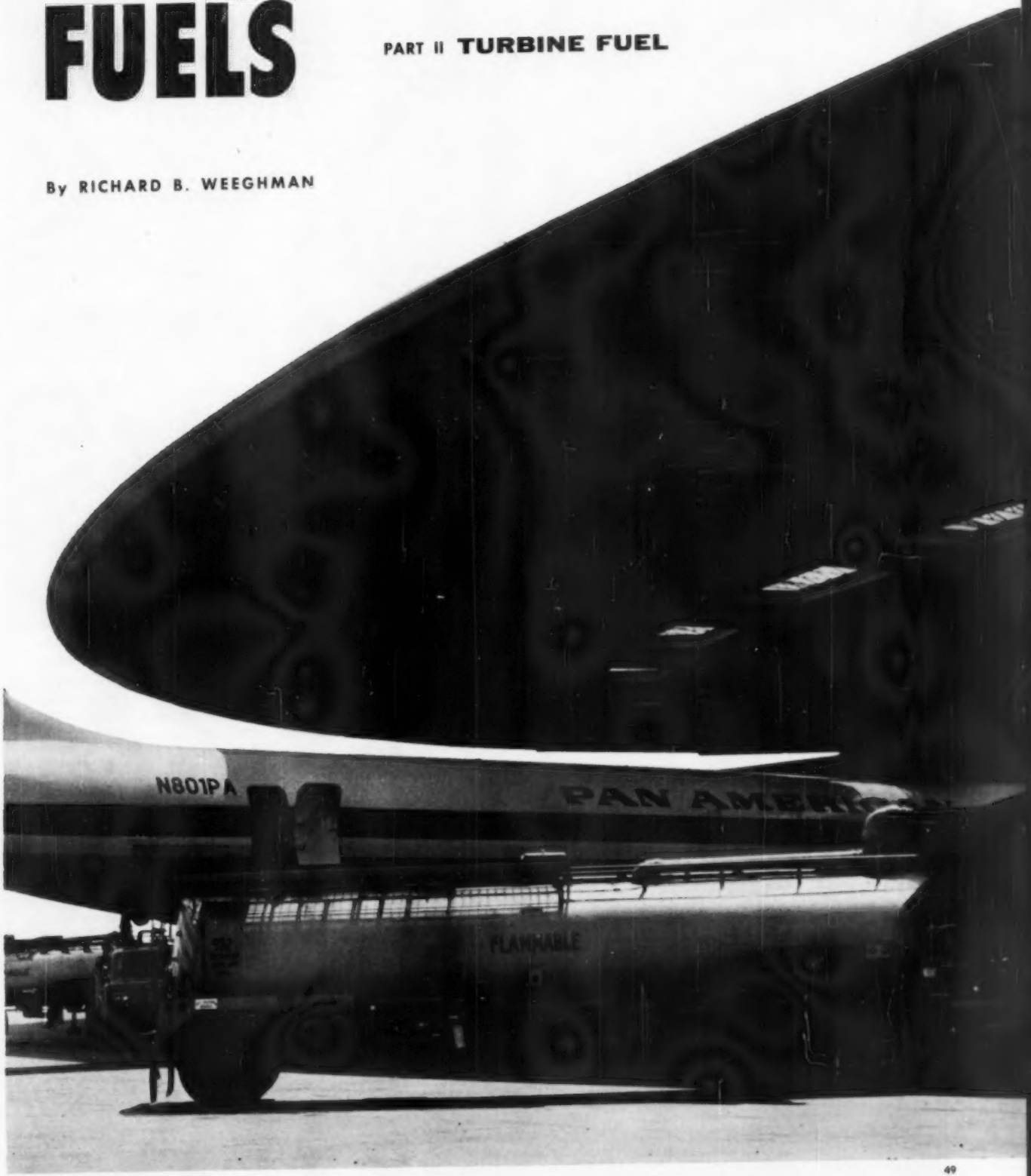


Douglas DC-8 refueled simultaneously by fuel trucks at each wing at New York International Airport.

FUELS

PART II TURBINE FUEL

By RICHARD B. WEEGHMAN



The light, responsive CL-41 is Canada's answer to one-airplane training for all student pilots

CANADAIR'S

LIGHT JET TRAINER

By RICHARD BACH

OVER THE LAST two years, Canadair Limited has gambled two and a half million dollars in developing a diminutive, unassuming single-engine jet trainer called the CL-41. The Montreal company, a subsidiary of General Dynamics Corporation and manufacturer of the world's first swing-tail cargo transport (see CL-44 pilot report, October FLYING), has received an order for 190 airplanes from the RCAF as a result of the gamble, and is hoping for further orders from NATO air forces.

FLYING was the first magazine to evaluate the prototype CL-41, which until recently has been flying with its right instrument panel filled with test equipment and with only left-side controls installed. The trainer, first of all-Canadair design, was the first airplane to fly with the Pratt and Whitney JT12 turbine engine, in January 1960. The 2,400-pound-thrust engine, weighing but 430 pounds, is now also in flight with the Lockheed JetStar and North American Sabreliner (see FLYING for March and July).

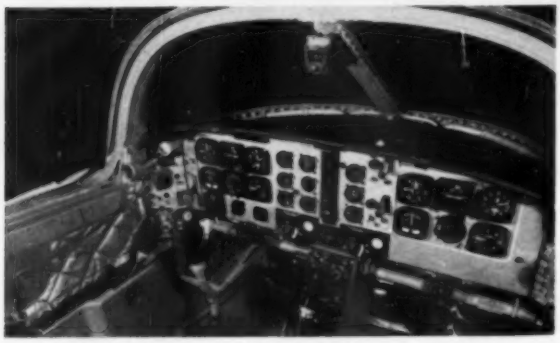
With flight testing completed, the airplane has been flown by the RCAF, which assisted with trainer requirement recommendations, the German Luftwaffe, the air forces of Sweden, Belgium, Holland, and the U.S. Navy. Designed for the complete range of training, from primary through advanced, the CL-41's economy and relatively low initial cost are points well in its favor in world competition.

After a routine preflight, and with Canadair pilot Donald Freeborn in the right seat, I climbed easily into the left and fastened the standard shoulder harness and seat belt. Rudder pedals are adjusted through a smooth-turning knob at the bottom of the instrument panel.

A left-to-right check of the cockpit showed a hydraulic hand pump for emergency landing gear and flap extension, a conventional throttle quadrant, an austere block of six standard flight instruments directly in front on the panel, engine instruments, and controls for the five-liter liquid oxygen system. A strip of warning and caution lights are to the right of the student (left seat pilot); radio control panels and a duplicate throttle quadrant are mounted on the center console between the two ejection seats. Toggle switches on the

Below: CL-41 painted for exhibition tour through Europe. Air intake screens preventing engine damage from foreign objects retract with landing gear.

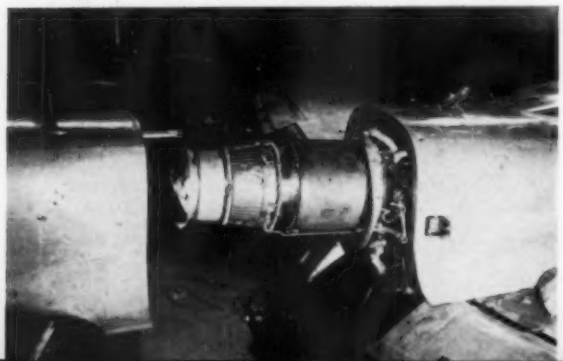
Above: Rugged, rectangular lines are evident in test flight photograph. First airplane flew 114 flights before tire change became necessary.



Above: Photo taken before installation of right-side controls shows uncrowded instrument panel and console in wide cockpit.

Above: Canadair pilot Don Freeborn *(left)* and FLYING pilot Richard Bach after first magazine evaluation of the CL-41.

Below: Large engine compartment leaves space around Pratt and Whitney JT12, allows installation of four different engines.



console have a welcome feature in spring-loaded locks that prevent any but deliberate force from moving them. There is no fuel selector or fuel control in the cockpit other than the throttle.

The CL-41 is one of the very few single-engine airplanes that come equipped with an engine fire extinguishing system; the airplane impresses its pilot with the thought that it is built with safety in mind. The cockpit is stressed by two I-beams beneath the floor and the seats are designed to take an eight-G vertical and a 32-G transverse crash load. With a maximum dive airspeed of .8 Mach, the little airplane is stressed for flight loads of minus 3G to plus 6.67G.

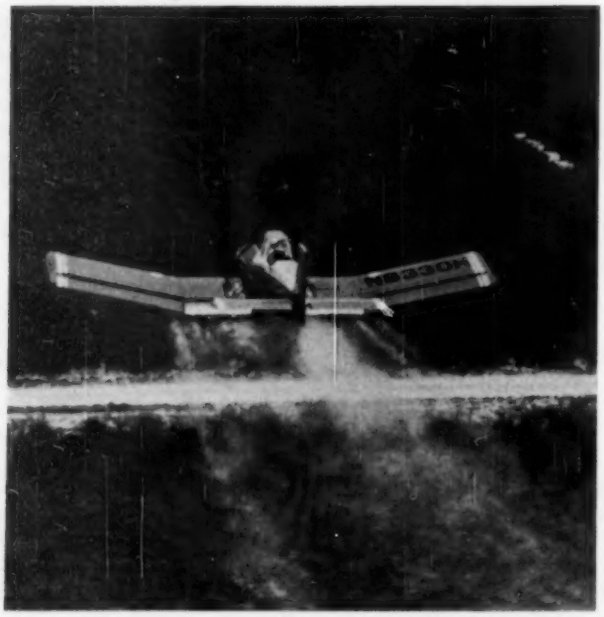
Starting the JT12 engine is about as simple as an engine start can be. With the battery, generator, engine master and inverter switches on and with external power connected, the starter switch is pressed to 'Ext' for three seconds. There is an 'Internal' position of the switch for battery starting, when external power is not available. The light compressor begins to turn, and at nine per cent rpm, the throttle is snapped around a detent to 'idle'. The engine accelerates quickly to idle rpm at 43 per cent, and you are ready to taxi.

The airplane is quite maneuverable on the ground and can turn in a 37-foot circle using nosewheel steering or brakes for directional control. It was a little bit of a task, however, to hold the nosewheel steering button down as required during taxi, and during a long and twisting taxi route, you might wish you could simply press the button once to keep the nosewheel steering engaged.

With the wide clamshell canopy electrically closed, and the green elevator trim light on, the airplane taxied into position on Cartierville Airport's runway 28. Wind was 25 knots gusting to 30 at 270 degrees. In a check of engine acceleration, the (*Continued on page* 82)

Grumman Ag-Cat (450 hp).

Above: Piper PA-18A.
Below: Transland Ag-2.



AG

A challenging profession with high potential for the future and a demand for young pilots. An expert presents a thorough review of facts and fallacies

By MURRAY A. KAHN

Among aircraft especially designed for agricultural chemical spreading are the Piper Pawnee, above, and airplanes at the left.

FLYING

THE FIRST SACK of chemical dust was dropped on Nevada soil from an airplane in 1918. And since then the agricultural flying industry has become an important segment of one of the world's most needed and vital aids to the global breadbasket.

The term "Crop Dusting," as it is most commonly referred to by flyers, is aviation's most misunderstood and feared occupation, and because of this misconception it has become one of the highest paying professions for pilots. The fallacies of the dangers of "Ag" flying are many, and as in everything else, ignorance has always been the cause for misunderstanding.

Less than one per cent of all the world's pilots enter "Ag" flying as a career. This lack of interest, or possibly fear, stems primarily from the imagined peril of low flying and the supposedly dangerous chemicals used. There are many other reasons for the lack of interest shown by most pilots to enter this profession, such as absence of glamour, getting one's hands dirty, and the desire for most airmen to seek the scarce "cream" jobs as corporate and executive pilots.

These are some of the reasons for the shortages that exist, and the golden opportunity for those who make this type of flying their career.

Employment opportunities are world-wide. It is estimated that the present rate of retiring "Ag" pilots due to age, sickness and other factors, is far greater than the rate at which pilots are presently trained to replace them. More and more "Ag" aircraft are being manufactured as greater crop yields have become necessary to feed the world's exploding populations. The field of "Ag" pilot opportunities continually will get better for those who are in the industry. It is therefore not surprising that low-hour "Ag" trained commercial pilots are able to obtain flying jobs, while pilots with high non-ag flying hours and all kinds of experience cannot find work. This is one speciality that pays off.

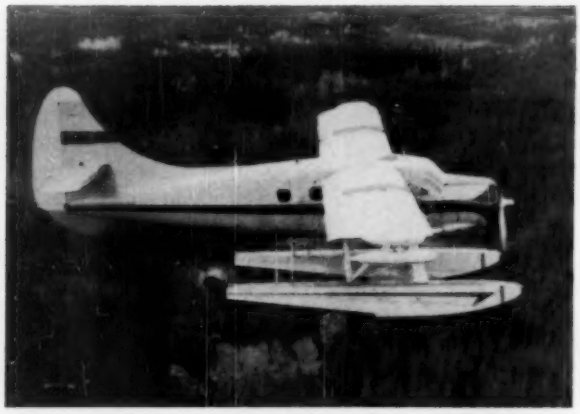
The "Ag" industry faces severe bottlenecks for qualified pilots in the not too far future and unless more pilots enter this vital field, the situation may become a very serious one. Surprising as it is, the "Ag" industry has no age limit. In fact, most "Ag" pilots are now in their 40s, 50s and even pushing 60. These men are a carry-over from prior to World War II and of the post-war years. Young men with renewed vigor and energy are desperately needed to stimulate this ever challenging profession.

It is true that "Ag" flying presents many hazards and can even result in some bad (*Continued on page* 100)

Business Flying in Canada

Long the aerial domain of the engineer and geologist seeking natural resources, Canada now spurs executive flying growth

By JAMES MONTAGNES



Top: Mining company's de Havilland Beaver teams up with the dog sled at a northern mining camp. *Above:* Float-equipped de Havilland Otter used to fly executives and geologists. *Right:* Another mining company utilizes one of many lakes to extend operations. *Far right:* Field Aviation Executive Aircraft Centre at Toronto International Airport in Malton, Ontario.

Right: Ramp view of the Centre at Malton. Indicative of the growth of business aviation, it is one of a growing number of organizations formed to service, rent and sell aircraft.

In Canada business aircraft fly executives between cities and also into the far north. It is not unusual for company executives, engineers and geologists to be flown into remote mining sites and potential mining camps close to the Arctic Circle. Business aircraft are being used more and more for this purpose.

It is estimated that there are about 1,000 company-owned aircraft in use in Canada, ranging from single-engined three-place jobs flown by salesmen-pilots to four-engine jet aircraft to take chain department store, brewery and bank executives throughout the Americas.

Largest users of aircraft in Canada are oil, mining and construction companies. Far-flung operations of these industries make their use imperative. While there are many charter air services in Canada, the large contractors, oil and mining firms prefer to use their own airplanes, whether the job is only a few hundred miles from a major city or north of the Arctic Circle.

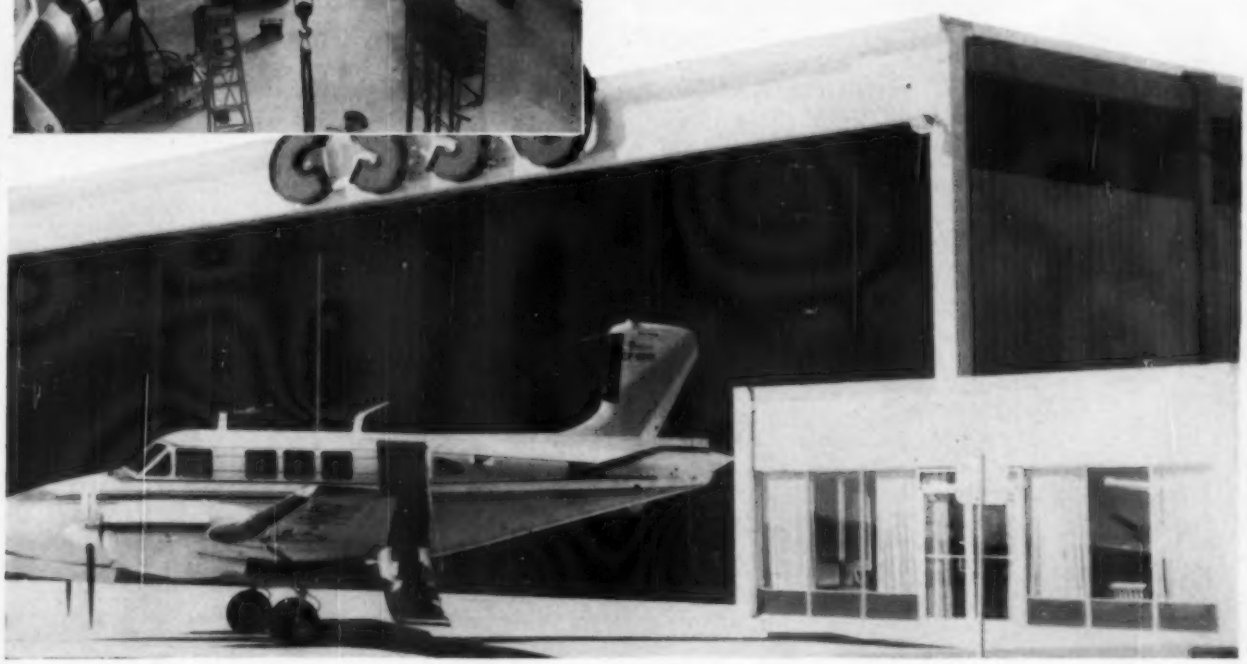
Oil companies, for example, have been carrying on an extensive search in the past few years for new oil deposits on the islands of the Arctic, north of the Canadian mainland. During the short summer season they use Canadian-designed de Havilland Beavers to fly geologists into the region. One party last year covered 11 of the larger islands with a couple of American-made Piper Cubs. The Piper Cubs were chosen in preference to helicopters because they have a longer cruising range, more speed and are cheaper to operate. On busy days they made as many as 17 takeoffs and landings, each time under what normal airlines would call emergency conditions. The ground is rarely flat and frequently strewn with boulders. Landing wheels equipped with balloon tires inflated to only four pounds pressure absorb much of the shock of landing on rough ground, and support the aircraft on soft ground or snow. The planes flew the geologists anywhere from five to 100 miles from a base camp every day. The pilots waited, sometimes for hours, while the geologists mapped the types of rocks on the island and took samples.

Canadian contractors and companies selling construction equipment are extensive users of business aircraft. Some contractors have three or four of their own planes to take engineers and executives to jobs all over Canada. With Canadian contractors and engineering companies expanding their operations to the West Indies and Latin America, these business planes are now flying frequently from eastern Canadian cities via Miami to points in the Caribbean area.

The first jet executive aircraft were delivered in Canada late in 1961 to the Department of Transport at Ottawa.

The department uses these and turboprop aircraft to fly inspectors and airport engineers from one end of the country to the other. United States jet aircraft will be delivered to Canadian department stores and brewery firms early in 1962 for use of sales and merchandising executives.

In western Canada many farmers are using single-engined aircraft to cover their vast acreages and to fly to nearby towns and cities for selling and buying trips. Some farmers use several (*Continued on page* 142)



THE PRO'S NEST

LIGHT TWIN FLIGHT PROFICIENCY

The ability to respond quickly and correctly to unexpected situations separates the good pilots from the bad. Some pointers for improvement

By TED DUROSKO

PROPER PROCEDURES to handle in-flight problems safely and efficiently while operating a twin-engine aircraft are important. They are easy to forget, especially if you have not flown recently. Just ask yourself these questions when taking off next time. Can you maintain partial panel IFR, or quickly recover from unusual attitude? Can you maneuver safely at minimum airspeed when the aircraft picks up a load of ice or when the engine or the propeller malfunctions?

Here is an outline designed to improve your proficiency and keep procedures sharp in your mind as well as point up the areas where more practice is needed.

Partial panel IFR: At cruise altitude, cover the artificial horizon and directional gyro, and fly by turn needle, ball and airspeed indicator. Practice climbs and descents straight and level flight at cruise power setting.

Try some timed turns. From straight-and-level flights apply control pressure to start the turn and note the position of the clock second hand. Enter the turn smoothly and hold the desired rate of turn until the hand of the clock has passed the desired time. On most turn indicators, a one-needle-width turn will give one and one-half degrees per second, a double-needle-width turn will give three degrees per second. Recover from the turn using the same control pressure used in the entry.

Check yourself on the smoothness of the roll-in and roll-out, the timing, and the control of altitude and

Partial panel IFR, recovery from unusual attitudes, stalls, go-arounds and single-engine operation are maneuvers to practice for proficiency.

airspeed. After rollout, check the accuracy of your turn by a peek at the directional gyro.

Recovery from unusual attitudes: This is any attitude that is not encountered in normal instrument flight. An unusual attitude can result from turbulence, vertigo, or carelessness in cross-checking instruments. Again, use only partial panel for reference.

When you recognize an unusual attitude, immediately check the altimeter and airspeed indicator to determine where the nose of the aircraft is above or below the horizon. An altitude gain and a low airspeed reading indicate a nose-high attitude; loss of altitude and high airspeed indicate a nose-low attitude.

From a nose-high attitude, with low airspeed, recovery follows the mechanical sequence of adding power as required, lowering the nose, and leveling the wings. The moment the airspeed and altimeter reverse their indications, the aircraft is in level flight. Glance at the altimeter reading at that moment, and then hold that altitude to stabilize in level flight.

From a nose-low attitude with high airspeed, reduce power as required, level the wings by centering the turn needle, and ease the nose back to level flight. Once again, when the airspeed and altimeter reverse their indications, the aircraft is in a level attitude.

Once regaining level flight, watch the altimeter and turn needle to prevent the aircraft from entering another unusual attitude. Keep in mind that the control pressures generally used in recoveries from unusual attitudes are greater than those used in normal flight, so care must be taken to neutralize the pressures as the aircraft approaches straight-and-level flight.

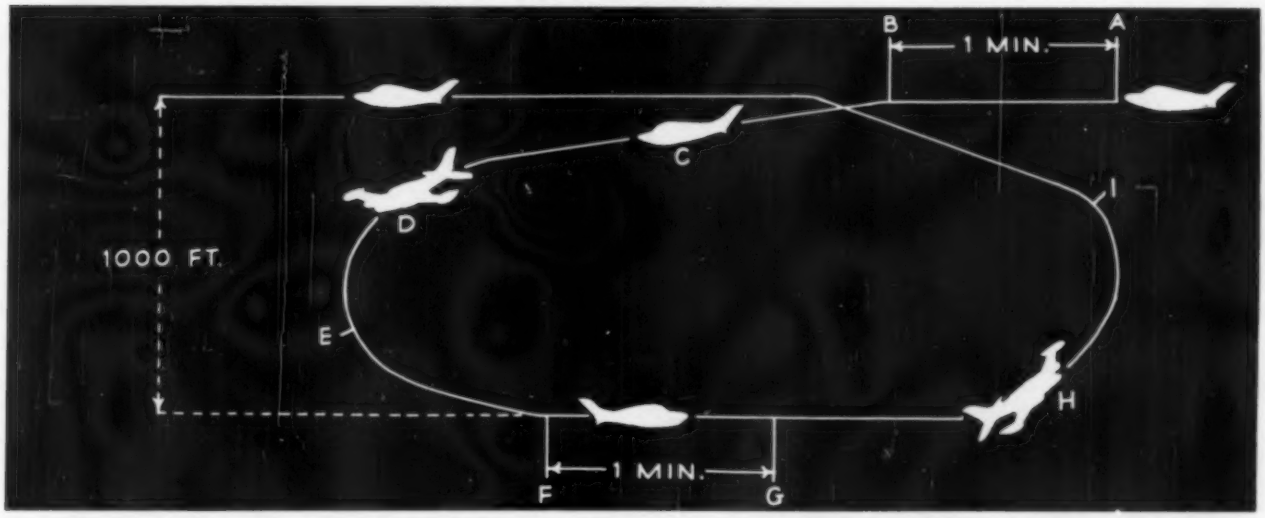
During this practice session, try for prompt and effective corrective action. However, remember that smoothness of control movement is essential, not speed. Keep altitude loss or gain to a minimum during the recovery; climb or descend to the original altitude once the aircraft is under full control.

Stalls: Prior to maneuvering the aircraft at minimum speeds, a review should be made of the stall characteristics of the twin being flown. In general, larger airplanes have slower responses in stalls and in slow-flight maneuvering. Because of this, stalls should be performed at higher altitudes to allow recoveries to be completed at least 3,000 feet above the ground.

For practice sessions, stalls should be limited to partial ones, with recoveries initiated at the first physical indication of the stall. Full stalls in multi-engine aircraft weighing 6,000 pounds or less are not, generally speaking, unduly violent or hazardous, but subjecting the aircraft to the loads and stresses of a full stall does not really accomplish too much as far as experience for the pilot.

Try stalls with various flap and power settings and landing gear positions; notice that the extension of the gear usually causes little difference in stalling speed, but means a more rapid loss of speed in a stall approach.

In all stall recoveries the controls should be moved smoothly, avoiding sharp pull-ups which might result in secondary stalls. Pull-ups from stall entries should be gradual to prevent momentum from carrying the airplane into a more-than-normally-high nose-up attitude with a resulting deceptive low indicated airspeed when the stall occurs.



Oblique circuit designed to develop skill in rapid descent and pull-ups, ability to hold constant heading and altitude, and correct angle of bank.

Enter power-on stalls with cruise or climb power, and with bank up to 30 degrees.

Recover with added power, retracting the flaps and gear. Level the wings and simultaneously apply forward pressure on the control wheel until flying speed is reached. Maintain level flight by reference to the altimeter and let the airspeed increase.

In performing power-off stalls, use zero-thrust power settings and again approach the stall either with wings level or in a bank up to 30 degrees. To recover, apply climb power and forward pressure on the control wheel, and follow the same routine as for recovery from the power-on stall.

Maneuvering at minimum flying speed: For this exercise use the full panel. Slow the airplane down to about 10 per cent above the stalling (*Continued on page* 90)

INDUSTRIAL GIANT OF THE AIR AGE

PART III

NORTH AMERICAN AVIATION

All-out commitment to scientific effort brings outstanding achievements by minutemen for a slumbering, trustful nation

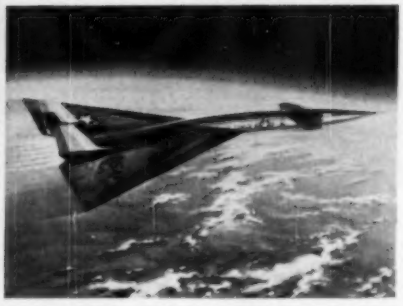
By GILL ROBB WILSON

Kindelberger's first jet, the Navy FJ-1 Fury.

Navaho long-range surface-to-surface missile.

Rocket research X-15 and pilot Scott Crossfield.

The famed F-86 Sabre jet, foreground, and B-45.



Valkyrie B-70 Mach 3 bomber, artist's rendering.

Left below: Aerial view from the east of the Downey, California plant where T-28s were manufactured. Right: Company's modification center at Fresno.

Collapse of the Axis in Europe came before scientific air power was far matured; a single pair of atomic strikes in Japan constituted the sole experience of nuclear weapons.

However, the hammers of Thor on the anvil of WW II had forged an awesome potential. None could forecast its portent when fully exploited and welded into military systems, but airmen believed it had implications of a new world order. Need to know was imperative.

Regardless, free governments and peoples had illusions of "one world" without further blood, sweat and tears. An explosive decompression of reality in the cockpit of the American ship of state forced her down to cruising in the turbulence of compromise. But who cared? Peace—it is wonderful!

The American aircraft industry fell apart—starved. The continuous program of research vital to our need was denied. At its wartime peak in October, 1943, North American had 91,000 employees and just before the Japanese surrender in August, 1945, had orders on the books for 8,000 aircraft. Shortly thereafter the company could muster only 5,000 employees and had orders for 24 airplanes! The complex of plants at Kansas City and Dallas was closed. Inglewood was more than adequate to Kindelberger's remnant.

The Soviet avidly seized on the opportunity. Pillaging German technology, conscripting German scientists and engineers, buying free traitors, playing on the gullibility of recent allies, and by espionage and satellite conquest the Reds gained a long head start in developing the potential of aero-space technology. Thereby hangs the tale of Russia's swift duplication of the atom bomb, of Soviet jets, of Sputnik, of the first-man-in-orbit and other airpower triumphs.

And in contrast, once again as in pre-war years, the fate of the United States rested almost solely with the voluntary dedication of a handful of air industrialists—they who have been called "munitions makers."

Wartime production at North American had precluded extensive research in future technologies of air power. However, midnight studies had crystallized Kindelberger's decision as to the company's policy—all-out commitment to scientific effort. In '45, a formal missile study had involved electronics and nuclear propulsion. Management could see that North American must ultimately organize in these fields, but first must come concentration on jet aircraft. This area alone was a formidable frontier. Could men and machines live in the environment of compressibility, of thermal savagery? More than aerodynamics was involved. Could North American come up with vehicles for cruising to the outer shores of the atmosphere, for penetrating the sound and thermal barriers, for packing lethal loads to global ranges? That was the challenge and the stake was the fate of the free world.

During the latter part of the war, North American had sought to squeeze a last utility out of conventional fighters by bolting two Mustangs together with a single wing. The resultant P-82 had phenomenal range and fighting or reconnaissance ability: 272 were built. But it simply didn't have the horses of a jet and it closed out the era of piston fighters. Kindelberger's first jet was a Navy fighter, the FJ-1 Fury, flown initially in 1946. It was fast, but was unsuited aerodynamically for transonic speeds. Another early one was the four-jet bomber, the B-45 Tornado, America's first.

From left: Eugene Zuckert, former Assistant Secretary of the Air Force, presents Presidential Certificate of Merit to J. H. Kindelberger in '48.

J. L. Atwood, pres. and chief exec. officer; H. A. Storms Jr., pres. Missile Div.; R. A. Hoover, test pilot; G. S. Welch, chief engineering test pilot.

Conceived as early as '44, it was flown in March, '47, and in service justified its creation—it was fast beyond any conventional fighter and versatile. North American built 143.

And now came an airplane of destiny—the F-86 Sabrejet. Initially designed in '45, the Sabre subsequently received the full focus of North American's research, which transformed the original straight-winged Mach .8 design into the world's top fighter. With swept wings akin to German concept, all-movable horizontal stabilizer, hydraulic power for controls, full pressurization, artificial sensitivity in the stick, radar, and other innovations, the now transonic F-86 was available in time for Korea. There it outkilled the vaunted MiG 14 to 1 and thwarted the Soviet bid for control of world skies. Such was its character that it ruled the roost for almost a decade and was built to the number of 6,232 by North American alone; additionally by foreign companies in Canada, Australia, Italy and Japan to a total of 2,500.

Does this make the postwar resurgence of North American seem too easy? Actually, before hitting the jackpot with the Sabre, company fortunes saw many months of desperation. Survival was a hairline matter.

Despite Kindelberger's resolve, the pots and pans industry came close to getting an unwelcome and reluctant recruit. Perhaps if aircraft tooling had been more adaptable to other uses, such would have been the case. But in the economic nature of things, it was a question of sink or swim as an aircraft company.

Inglewood took one long shot (*Continued on page* 151)

NEEDED...
A BETTER PROGRAM FOR OUR AIRPORTS

THE TIME HAS COME to start considering aviation's problems as a whole and not as a series of disjointed matters that, if left alone, will fall into place.

Unless changes are made soon in the basic thinking about airport construction and the rules governing it, this problem will become as acute as the present jam on the airways.

President John F. Kennedy in his "Project Horizons" wants a plan for flight to extend into 1970. The emphasis of the plan has been laid on the scientific control of aircraft in flight.

Very little thought is being given to the fate of the airplane once it has safely touched down.

In the recent past there was a great clamor to update the airports to handle jets. Millions were spent to accommodate the new type of aircraft.

But for the most part the work done was extending, widening or re-enforcing present accommodations. Very few really radical plans were put into effect to suit the jet age and even less was done, or planned for, to handle the rapid increase of light and executive type of aircraft.

Presently the industry is at a major crossroads in its thinking about airports.

It is going to take bold planning and much money to correct a bad situation whose trouble will pyramid with time.

For the past 14 years the concrete, brick and stone end of the industry has been in a state of constant flux.

Basic requirements changed from month to month. It was left pretty much to the whim and fancy of the Federal Aviation Agency or its predecessor the Civil Aeronautics Administration.

National plans and goals would be solemnly announced. But the ink would hardly be dry when the changes would creep in to make life miserable, and in some cases impossible, for the airport builders.

The method and formula the FAA used to provide matching federal funds for a project changed more often than a wind sock direction on a gusty day.

The urgency and scope of the situation is reflected in the results of the national airport survey made by three of the more influential aviation organizations in the nation.

The National Assn. of State Aviation Officials, The Airport Operators Council and the American Assn. of Airport Executives sponsored the survey.

The complete results and the evaluation of the survey are revealed here.

In the 50 states and Puerto Rico there are 7,600 airports, 3,631 of them public fields.

To get a wide cross section, questionnaires went out to 3,364 airports. Of these 1,543 replied.

Since August 1960, the questionnaires have been coming into the office of the Michigan Department of Aeronautics, which had been selected to conduct the compilation of the results.

The evaluation has proved there is a great need for change in three basic areas concerning the construction of airports.

Jets can no longer be solely blamed for the high airport construction costs.

Much of the red tape must be eliminated to cut down on the fantastic length of time needed to complete projects.

The basis for allocating funds must be changed to end present inequities and uncertainties.

The survey shows that $1,125,044,435 will be needed in the next four years to complete needed projects.

The present act, which expired June 30, was originally passed to last four years. It later was given a two-year extension.

This federal airport act provided funds on a matching

Snarls of red tape and awkward formulas for money allocation threaten to impede growth and vitality of general aviation

By FRANK A. HAND

Greater Rockford Airport in Illinois, a typical business flying facility.

basis of 50 per cent federal money with a 25-25 per cent share from state and local units of government.

Optimists are hoping for a new act that will give $100 millions for each of the coming four years. However it is highly doubtful the present limit of $63 millions will be substantially increased. The FAA has proposed legislation providing $75 millions annually for the next five years.

The reporting airports said they were anticipating $588,065,244 from state and local sources. The additional $536,979,211 must come from federal aid.

Now even if the optimists with their $100 million figure are right, the whole program still would be short $136 millions.

The air carrier fields, 501 reporting, need $964,798,888 to complete their projects. The 837 general aviation fields that reported back said they have plans for projects amounting to $160,335,547.

One of the more interesting parts of the balance sheet shows that one-third of the money requested goes to the large hubs each handling more than 509,000 passengers a year.

Proportionally these fields represent only 5.5 per cent of the total airport system.

Medium hubs each handling up to 509,000 passengers per year are going to need $148,817,515. These fields represent 6.5 per cent of the total.

Together these fields, which represent 12 per cent of the total, will need 47 per cent of the funds.

The 53 per cent, or $599 millions, have been requested by the small and non-hub fields and the general aviation airports that never see a jet airliner. These represent 88 per cent of all airports.

This is a reflection on the great changes made in general aviation in the past years.

The corporation which has invested thousands into an additional business tool does not want it sitting idle on a grass field without lights or navigation aids.

The businessman is demanding more of the airport regardless of its size and ownership. To meet his demands the airport is going to have to get some outside help from the federal and state governments.

Today the giant of aviation is no longer the high, fast-flying jet airliner. It is the privately owned aircraft, which makes up close to 85 per cent of the nation's plane population.

Presently it takes 179 weeks, three and a half years, before a project which receives federal aid can be complted.

This is the record compiled by one of the nation's most active aviation states—Michigan.

Since 1956 there have been 107 projects started in Michigan under the federal airport aid program.

Nearing the end of six full program years only 20 projects have had the books closed on them. Fifty-six others have been completed, but for some reason or another final federal funds have not come through.

Not all of the fault can be placed on the shoulders of the federal government. Some of it must sit with state government for not supplying the manpower.

But the manpower shortage on the state level is mostly the direct result of federal procedures. These are so complicated that top-flight engineers cannot be utilized in the job for which they were hired.

Instead of engineering, they are forced to become glorified, highly paid bookkeepers keeping track of the ungainly amount of figures required by federal sources.

Michigan, under the direction of James D. (Jay) Ramsey, has moved into the forefront of airport building activity. But the state must sit by and watch engineers use little or no engineering discretion because every small change in a project *(Continued on page 110)*

At the end of his journey, Walter Moody clears London Customs. His Mark 21, the author says, was the first single-engine airplane allowed to land at Heathrow since end of World War II.

Non-stop across the

Out to prove that the best way to ship airplanes is to let them fly themselves, a ferry pilot reports a routine 20-hour cross-country flight

By WALTER MOODY

G-ARNA, a trim little blue and white Mooney Mark 21, sits on the line at Logan International Airport in Boston. It is loaded with gasoline and survival gear.

The plane is ready for a non-stop transatlantic crossing to Heathrow International Airport, London. Permission to land at Heathrow has been withheld from single-engine aircraft since World War II, so G-ARNA will be the first to touch down its wheels at the airport in 16 years.

This is one of those more pleasant days in Boston. The sun is hot and seems intent on burning off the haze which brushes the sky like a covering of burnished gauze.

I have planned a non-stop flight, not outstanding by itself, since the Mark 21 has been flown much farther several times. What does make the flight outstanding is the fact that I have filed an instrument flight plan and am committed to a definite arrival time.

The aircraft is the 1961 model of the Mooney Mark 21, a speedy, four-place, low-wing monoplane, powered by a 180-hp Lycoming engine. I took delivery of G-ARNA late in June for REA International of New York.

Purpose of the flight is not just to prove that a single-engine airplane can be flown safely non-stop under IFR conditions over 2,000 miles of water and half that distance over land. The real purpose of the flight is to confirm the thinking of Mooney Aircraft officials who believe that commercial ferrying is a more practical way of delivering aircraft overseas.

Sea freighting has been tried by Mooney, and while the cost is slightly less, the Mark 21 has to be re-rigged at an overseas installation. Re-rigging any high-performance aircraft can be troublesome, particularly if the mechanics are not thoroughly familiar with the airplane.

I have advised Dick Wales of REA International of New York, export company for Mooney Aircraft, Inc., and Gene Locke at Max Conrad Aviation of Lock Haven, Pennsylvania, of my scheduled ETA for London. Lord Zetland of R. K. Dundas in London has also been informed of my time of arrival at Heathrow.

I am scheduled to arrive at 1330 GMT Saturday, July 1, a flight of little more than 20 and a half hours.

The forecasters at the weather bureau at Logan have given me adequate briefings and provided a detailed route weather folder. They indicate the probability of encountering a line of heavy thunderstorm activity over the Maritime Provinces. Good weather is forecast for the balance of the trip once I clear this squall line. Weather should be good at London terminal, I am advised.

On the basis of the forecast, I have requested 3,000 feet to Yarmouth, Nova Scotia, 5,000 feet to Sydney, and 7,000 feet to Gander, Newfoundland, which will clear me over the Maritimes. For the balance of the trip I have asked for 9,000 feet. With an estimated 20 hours and 45 minutes elapsed time, I must be airborne by 1645 zebra hours to make the London ETA.

Preflight check is completed and the engine is running smoothly. Ground Control tells me to taxi out on Runway 32. The sun has dipped behind some clouds and the day is momentarily gray now. I am vaguely annoyed because I am running a little late.

"Mooney November Alpha, I have your clearance. Are you ready to copy?"

"Boston Ground Control, this is November Alpha. Go ahead with the clearance."

"ATC clears November Alpha to the Yarmouth range, via direct East Boston control 1141 Yarmouth, climb to and maintain 3,000 feet, contact Yarmouth radio approaching for further clearance, your clearance limit will be London Heathrow. Contact Boston Tower on 118.3 for takeoff."

I read the clearance back and am directed into position. I taxi past an Eastern Electra, thinking he has a lot of power, and I wonder if he is going a little bit of my way in the same direction.

Now, as clearance is issued, November Alpha begins to roll. At 70 mph indicated the Mooney is floating; a little nose-up trim and I am making money. The gear is cleaned up and I reduce power to 2,500 rpm and 24 inches of manifold pressure. Boston's north shore comes into view as the indicated airspeed steadies at 96 knots.

My watch shows 1702 zebra. I am 17 minutes behind schedule and now estimate Yarmouth, Nova Scotia, at 1917 zebra. The route I have checked through from Boston to London is the shortest distance between two points. On a map or globe of the world it would look like a long curve reaching its high point at about Ocean Station Charlie, approximately 800 miles from the Cape Breton Islands of Newfoundland.

November Alpha is just slightly tail heavy and at 105 knots tends to porpoise slightly. To compensate I have the trim tab set nose high at 3,000 feet, and have settled down to routine flying.

Ahead I can see the squall line forecast by the Logan weather boys. It looks black and forbidding, but there are some light spots to the left, so I alter course and start through.

The stuff is scraggly on the fringe, like the dirty tattered beards of old men, but quickly it changes, becoming thick and surly, and soon heavy rain is punching at the windshield. The air, suddenly, is not smooth.

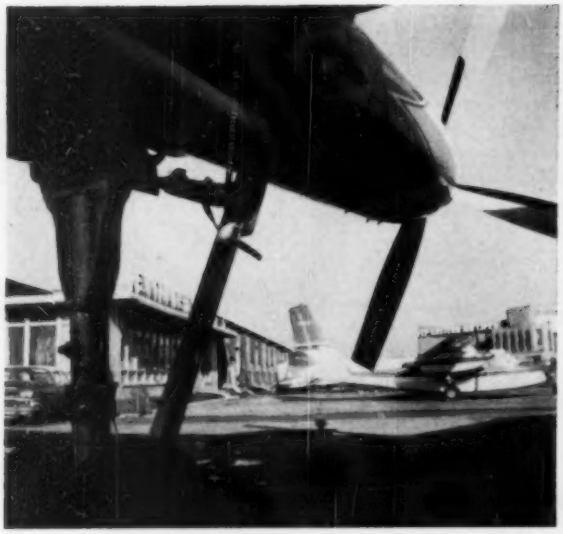
Ten minutes of fighting the controls and the Mooney has broken through. I can see clear skies and good sailing ahead.

Clear of the ragged squall line I contact Yarmouth and give them my estimate. (*Continued on page* 132)

Atlantic in a Mooney

The author in the airplane that flew him over the 3,000 miles of land and water between Boston, Mass. and London, England.

WHO BUYS,



In basic general aviation markets are company-owned airplanes, *left*, flown by company pilots, and those flown by businessmen themselves, *right*.

What makes general aviation tick. The motives, aims and driving forces that shape the destiny of a growing industry

By LESLIE L. THOMASON

WHEN JOHN CRAIG stepped off the jet airliner that had carried him nonstop from Denver to Los Angeles, a well-equipped private plane was waiting for him at the transient ramp. His schedule called for a meeting in a city which did not have airline service, 100 miles from Los Angeles; yet, he would be back in Denver in time for dinner.

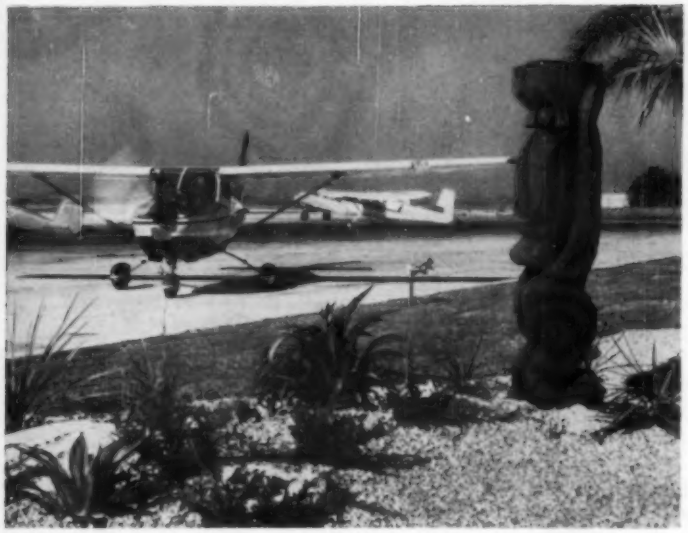
John Craig lives by tight schedules, flying commercially on long trips and renting a plane at the end of the line to service out-of-the-way places.

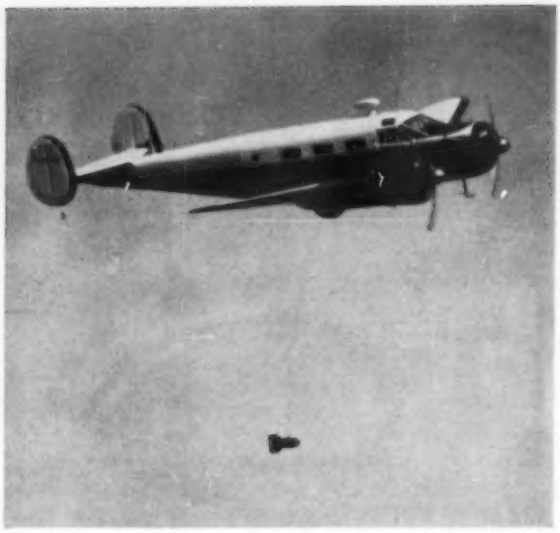
"In my own territory," he explains, "I fly a company plane. Nothing pleases a customer more than to say, 'Sure thing, Bob. I'll fly right over. We can talk about it at lunch.'"

John is one of the thousands of aggressive businessmen who are proving the dollars and cents of efficient use of private air travel.

Of the over 70,000 private planes in America, 41 per cent are flown for business use, accounting for a million

WHO FLYS, and WHY?





Others are represented by, *left*, non-company aircraft used for business and / or pleasure; and, *right*, those in specialized jobs like mineral surveying.

more aircraft hours annually than the domestic airliners. Five manufacturers of business-type planes added 7,500 new units to this active fleet in 1960. The *Curtis Report*, submitted to President Eisenhower in 1957, predicted that this business fleet will triple by 1975, and quadruple in the number of hours flown.

Bob Honaker, Oklahoma oil operator says, "I have strings of tools running in four states. I'd just as well shut down if I had to stop flying."

A major problem for firms doing business in smaller communities is that less than 600 American towns and cities have scheduled airline service. Over 6,000 communities, however, have facilities where the businessman-pilot can land his plane. A food packaging firm in Arkansas uses a fleet of single-engine craft to ". . . provide time-saving transportation for members of (the) staff, saving salary costs en route with better service to clients in locations not served by airlines or suitable railroad connections."

The economics back of this trend is found in the observation of a Texas consultant who says, "I am able to put in an additional business day every week, besides spending a lot more time at home."

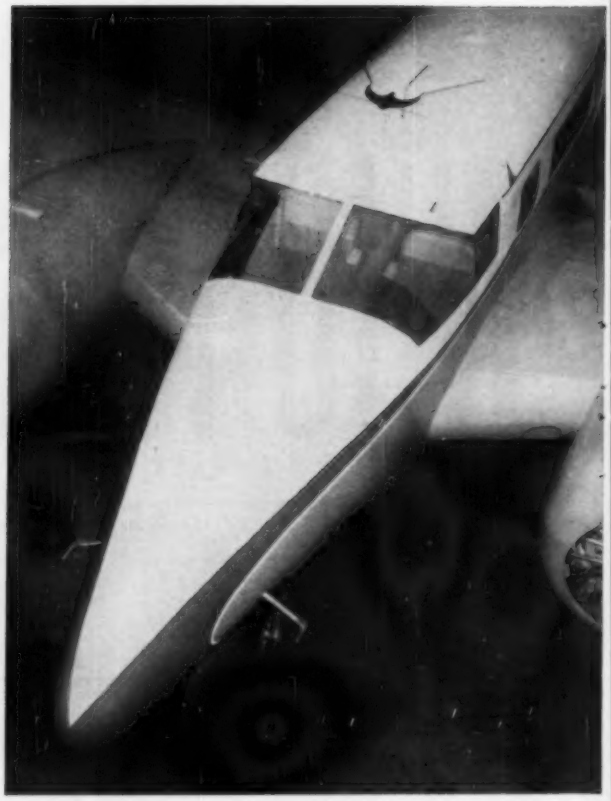
One of the most vivid testimonials comes from a nationally known firm which saved 284 hours of executive time during a two-month trial use of a four-place, single-engine plane.

General aviation (all phases of aviation other than military and airlines) is not only the largest segment of air transportation, but it is the fastest growing. Increased mobility of the labor force, decentralization of industry, the continued demand for trained and experienced personnel—set off against a condition of overburdened highways and limited commercial transportation in many areas—account in part for the growing favor of modern, executive aviation as an accepted mode of business travel. It permits a company to ". . . put its first team more places."

During a recent speaking engagement before a civic club in Western Oklahoma, (*Continued on page* 142)

VOLPAR'S

TRI-GEAR TWIN BEECH CONVERSION



Above: Extended nose identifies converted Beech 18. *Below:* Nose gear retracts forward, has maximum extension speed of 160 mph.

BEECH AIRCRAFT Corp.'s Model 18, known affectionately all over the world as the Twin Beech, has been in production for 25 years and, although upgraded in many respects over the years by the factory, has undergone major design changes at the hands of others as well.

What may well be the ultimate basic refinement of the piston-powered Twin Beech (turbine engines open a whole new era), is the increase of performance and maximum takeoff gross weight to 9,800 pounds and the incorporation of a tricycle landing gear.

Although speed, performance and gross weight increasing conversions are not new for the Twin Beech, it was just recently that an FAA Supplemental Type Certificate was issued to the combined tricycle gear and 9,800-pound gross weight modifications as done by PACaero Engineering Corp., Santa Monica, Calif., and its parent Pacific Airmotive Corp. at Burbank (FLYING, November, 1960).

The tricycle gear comes under the heading of "Why didn't someone do this before?" when pilots hangar-fly the venerable aircraft, for those who have flown it usually have a reverence of one kind or another for it, and the landing-takeoff characteristics and associated phenomena have long been a famous part of the airplane's reputation. During World War II, when the AT-7, AT-11 and C-45 were flying all over the globe, there were said to be two classes of Twin Beech pilots —those who had, and those who were going to (have a spot of landing or takeoff trouble).

In all fairness, it was not all the fault of the airplane per se. As better brakes and other equipment became

In what be may the last piston-engine conversion of the Beech 18, three wheels and higher performance

By RICHARD L. SWEENEY

The unusual sight of a tricycle Beech also indicates increased cruise performance, longer range, and a 9,800-pound maximum allowable gross weight.

available after the war, the Twin Beech's problems were ironed out, to an extent. However, it still had the conventional gear.

Although it probably is true that this pilot's almost gleeful reaction to the tricycle gear was somewhat influenced by the fact that he never forgot how he joined the "Those who had" club 15 years before in a C-45 at Tonopah, Nev., it nevertheless is definitely true that on any objective scale, takeoff, landing and ground handling characteristics of the Twin Beech on three legs not only make this phase of operations much easier, but probably even an enjoyable experience.

Developer of the tricycle gear and manufacturer of the unit is Volpar, Inc., of San Fernando, Calif. They appointed PACaero and Chamberlain Aviation of Springfield, Ill., as distributors for the gear kits. Although Volpar's is not the only tricycle gear ever developed for the Twin Beech, it is the only one certificated in combination with the 9,800-pound modification and offered as a package by PACaero at this time. First major display of the Volpar gear was at last year's NBAA show in Los Angeles.

Flight evaluation centering about the tricycle landing gear and the effects of the longer nose dictated by this installation included an ILS approach on the 11-mile plus Burbank course, in addition to landings with and without flaps. Other flights involving the gear and its effects included stalls at 9,000 and 11,000 feet with and without power, straightaway and in turns.

On the Burbank ILS it was clearly established that the longer nose and nose gear definitely do not detract from the airplane's stability or handling qualities; if anything, these new modifications enhance them.

Two flights were made in N118L, which is to be used by PAC board chairman John Myers, and includes some extras over and above the standard tricycle gear and 9,800-pound modifications such as a panoramic windscreen and large cabin windows. However, it retains some features of the conventional Beech which were left unchanged to show that gross weight increase and tricycle gear can be accomplished without running the price out of sight, PACaero says.

Empty weight of N118L is 6,734 pounds, and for the first flight gross weight approximated 7,920 pounds for takeoff including fuel and passengers. The aircraft was loaded to maximum 9,800 pounds for the second flight, ballasted to obtain the most aft CG position, and carried a special airspeed calibration boom on the right wingtip which had some effect on the plane's climb performance.

Both flights were made from Santa Monica, on days when the temperature on the ground and at altitude was considerably above standard.

Following takeoff on the first flight, with ground temperature at 76 degrees F, the airplane was trimmed hands off to climb at 130 mph IAS. The airplane sustained a 1,000 fpm rate of climb to 10,000 feet, where several speed checks were made.

Passing through 5,000 feet, outside temperature registered 80 degrees F with power set at 2,200 rpm and 32 inches mp yielding a corrected true brake horsepower of 365, or 81 per cent for the R-985.

At 8,000 feet, outside temperature was 62 degrees F, airspeed 116 mph IAS and (*Continued on page* 128)

There are many in aviation who feel

that they are talking to themselves too much and

holding too many meetings for the same people

Are trade shows necessary?

By LOU DAVIS

THE MAN and the company who pay the freight for meetings and trade shows are again asking this question:

"Are we wasting effort talking to ourselves?"

Too many meetings, many overlapping, are beginning to drain resources. Industry executives responsible for exhibit support of technical gatherings and organization conferences are finding a tighter dollar governing their decisions.

The obvious is happening. Air industry management is taking stock of its obligations and its sales promotion opportunities. It is placing meetings and exhibitions under the microscope to re-evaluate their worth in terms of new audiences, fresh exposure to influential, opinion-molding groups of more direct importance to sales.

The bitter truth gives just cause for every aerospace organization to pause for re-examination of programs. These questions should be asked:

Are industrial exhibits necessary? Are they giving exhibitors adequate exposure to the *buying* audience?

Are meeting schedules splitting company support and thus watering down returns on the promotion dollar?

An official of one aircraft company who, for good reasons, desires to remain nameless, made this appeal to FLYING:

"Two organizations meeting in California last fall failed to justify the expense of moving displays, planes and company exhibit personnel to the west coast. All we did was talk with the same people—other exhibitors and industry promotion people.

"It's getting to the point where we cart the same exhibit around the country to show to the same audience. I'm convinced we're on the same vaudeville circuit, drinking from the same coffee pot."

This same concern has been expressed by other business and industry executives of the aerospace industry. Tighter competition, the need for more direct sales effort and lower sales costs, are cited as just reason for "being among the missing" at industry clambakes. In line with increased sales resistance comes this suggestion:

In view of the fact that many of the meetings and expositions are of the same basic category—in some cases having overlapping missions—they should be consolidated so that company support is justified on merit alone. Multi-organizational meetings in one package should provide broader audiences, more effective exposure. Typical among the questions being asked by industry leaders are these:

Why can't Reading, Millville, NBAA, Air Traffic Controllers, Airport Operators, NAA, AOPA, NPA, ALPA, NATA, and similar organizations combine under one big, annual event?

Why not concentrate on the AFA World Congress of Flight system and combine Association of U. S. Army,

One disadvantage of the trade show is that it fails to provide contact with the public.

Sending personnel to the various trade shows and shipping exhibitions may run into considerable expense. Consolidation of meetings is one solution.

American Ordnance Assn., National Security and Industrial Assn., and Navy League activities into one giant but impact-wielding annual meeting?

Why can't technical societies such as SAE, ASME, ARS, IAS, IRE and similar organizations explore ways and means of scheduling joint meetings, both national and regional, to reduce amount of support required from industry?

Why can't quasi-military science and technical conferences having to do with procurement, scientific, maintenance, operations and other technical problems be scheduled sufficiently in advance to permit synchronization with existing organization meeting schedules that are compatible with the larger missions?

Organization problems have grown in complexity with the rate of industry growth. Splinter organizations and offshoots of technical societies have multiplied many times over. Consequently, any attempt at consolidation will first demand that compromises be made all along the line. Perhaps the time is ripe for many mergers.

Skyrocketing costs in displays, shipping costs and personnel expenses have taken company exhibits out of pure support category. The audience must justify the expense and—if it doesn't—many companies prefer making a small cash donation to support a meeting, rather than move a display unit out of the warehouse. Cost of display space is in itself a trifle compared to freight, installation and personnel costs that run into three figures.

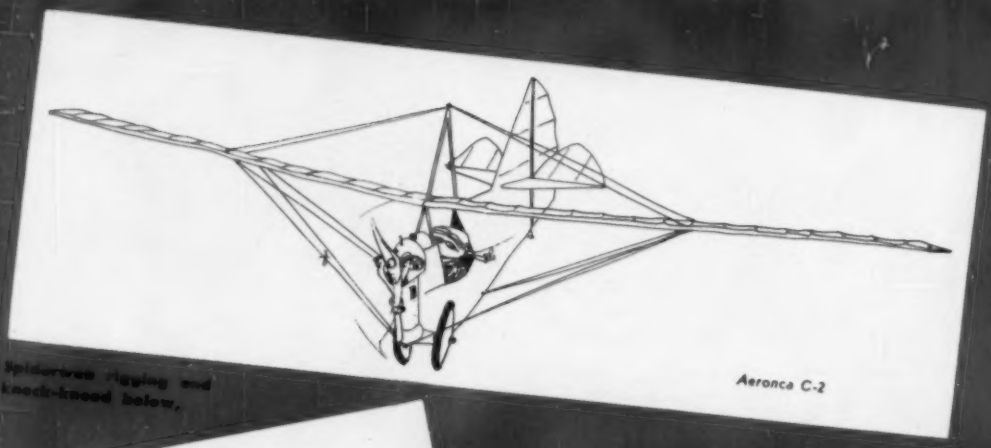
Since more and more aerospace companies are finding intense competition and just reason for the "hard sell" approach, exhibit platforms which offer broader audiences and increased exposure to multi-interest public groups are getting more concentrated attention and preferential treatment.

One market specialist offered this comment, "'Mileage' received from exhibiting at large multi-organizational conventions or conferences warrants high expense. Product or company image can be broadened and new sales development contacts can be made. The small, highly specialized trade show is riding a rough road because the majority of those attending are either competitors or technical people well informed about your own company and its product—They often consider your standard display 'old hat' because they know what's new in the pattern shop."

Trends among commercial (*Continued on page* 106)

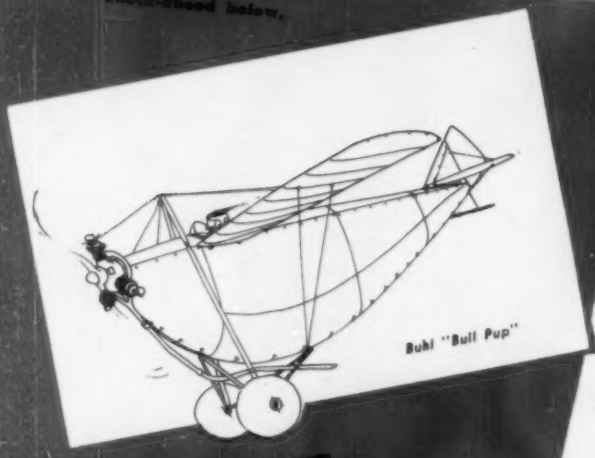
THINGS WITH WINGS

Sketch-pad fly-by



Aeronca C-2

Spidery wire rigging and knock-kneed below.

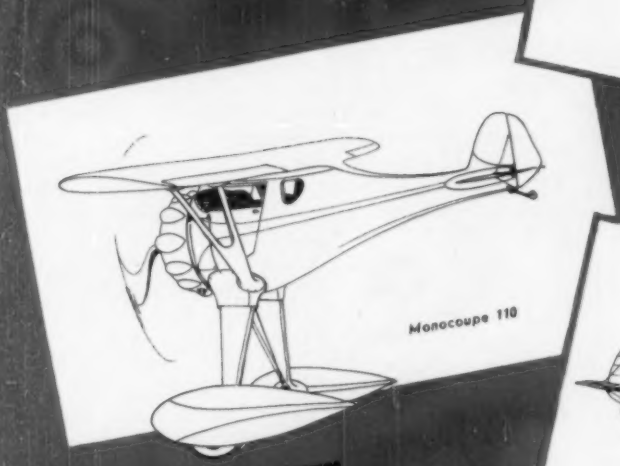


Buhl "Bull Pup"

Or big-bellied barrow and still rather slow.

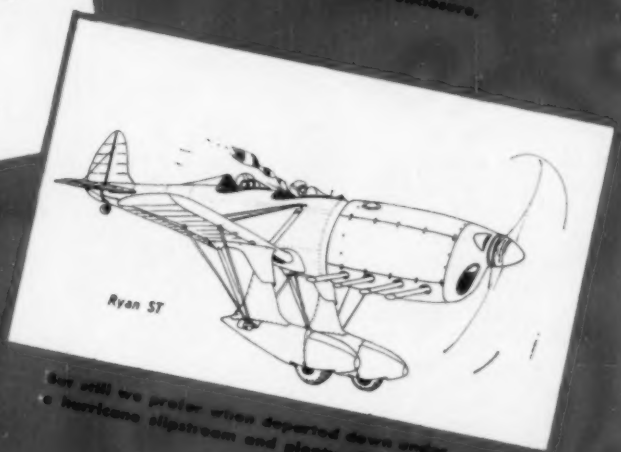
Fairchild 24G

But forebears for sure of a soundproofed enclosure.



Monocoupe 110

And streamline nerves that add to composure.



Ryan ST

But still we prefer wires departed down under
a hurricane slipstream and plenty of thunder.

Drawings by Robert Straub

Tips on aviation insurance

An interview with a pilot-broker shows that it pays to know what you're looking for when you buy

By JAMES H. WINCHESTER

TOO OFTEN when the question of aviation insurance is raised, the answer is a blank stare, a shrug of the shoulders and the admonition to "go find an expert."

Such an expert is Richard J. Berlow, who operates the largest specialized aviation insurance agency in the Eastern United States, from his office located at Teterboro Airport, N. J.

An Air Force lightplane pilot in the Pacific in World War II, Berlow got into aviation insurance 20 years ago, has been head of his firm for the past 13 years. Today his company, doing business largely in New Jersey, New York, Pennsylvania and Connecticut, writes over one-half million dollars worth of aviation insurance annually. About 80 per cent of this volume is insuring private and corporate fliers and commercial fixed base operators with tailor-made liability, physical damage and accident coverage.

Berlow clients, however, also include some of the most unusual aviators in the world—jungle missionaries, crop dusters, sports parachutists, powerline patrol fliers, fish-spotters and transcontinental racers, among others.

"You can insure any risk in flying today if you want to pay the price," he says. "But there are some requests that we turn down flat. A typical example would be an inexperienced pilot wanting coverage to fly a war-surplus B-26 or P-51 and a fixed-wing pilot wanting to take right off in a helicopter.

"Over and beyond the bad business of a wrecked airplane, we're not going to be a party to anyone killing themselves."

In this "special risk" category, Berlow recalls a jungle missionary group he insured in 1950 that flew a British flying boat in New Guinea. The plane suffered a forced landing in the jungle without much damage and the crew escaped injury.

"But by the time the insurance company's adjuster reached the location of the plane," Berlow says, "the cannibals had wrecked it by jabbing spears into it. The plane had to be declared a total loss."

What are the big whats, whys, whens and hows of aviation insurance, particularly for the private, corporate or fixed base fleet operator?

"First of all," Berlow recommends, "use the services of a specialized aviation insurance firm. If you try and seek out aviation insurance on your own, with a general insurance agent, for instance, you often find he's unacquainted with the unique mechanics of aviation placement: the proper company to use, underwriting requirements, even the type of coverage to buy. A regular insurance broker is too often awed by the seeming risks involved."

A specialist, and there are numerous brokers other than Berlow in the field, particularly in Texas, Florida and California, analyzes each individual application, for in aviation insurance, unlike other insurance areas, there is no standard policy. No two risks are alike. Each policy is individually negotiated.

Unlike other insurance, in aviation there is nothing automatic about renewals. Policies have to be renegotiated each year. It's a specialist's job, largely on the basis of the pilot's qualifications, the use of the plane and where and how it is kept when on the ground, all factors which can change greatly in a year's time, to determine whether the insured can get a lower premium, or perhaps have to pay a higher one.

In the United States there are eight major insurance firms which specialize or have special departments in aviation. They are: Associated Aviation Underwriters, U.S. Aviation Insurance Group, and the Royal-Globe Insurance Company Group, all in New York City; The Insurance Company of North America, in Philadelphia; American Mercury Insurance Company, Washington, D. C., National Insurance Underwriters, St. Louis, and of course, Lloyds of London. Much of the world's special-risk aviation insurance is placed through Lloyds.

Here, in question and answer form, are some advice and tips on aviation insurance, what you should know as a pilot or plane owner, for your fullest protection:

Q: What is the prime insurance concern of an airplane owner?

A: You should have $100,000/300,000 Bodily Injury, $100,000 Property Damage and $100,000 for each passenger seat as a minimum. The $100,000/300,000 Bodily Injury limit is similar to automobile insurance in that the lower limit is for any one person injured and the $300,000 for any number of people injured. However, lower limits are available, of course, costing some $15 to $20 less in premiums, but they usually provide only about half as much coverage. So, for the small savings involved, they are just not worth it.

Q: What ways are available of insuring the aircraft itself?

A: This is known as hull *(Continued on page 137)*

A new high performance battlefield surveillance aircraft backed by extensive research

BOEING'S

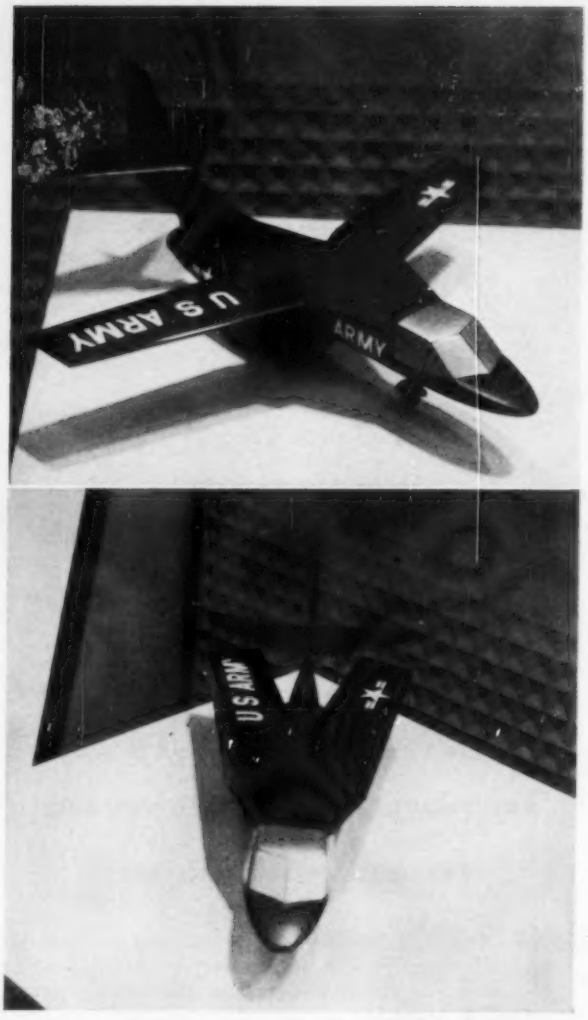
Variable sweep wing aircraft

By J. S. BUTZ JR.

The first, 1961-model, variable sweep wing design revealed by any manufacturer is the Boeing Airplane Co.'s battlefield surveillance aircraft shown here in model form. Its maximum wing sweep is more than 75 degrees to give a smooth ride at very low altitudes and speeds over 600 mph in turbulent air. To provide true short-field landing and takeoff performance and a minimum flying speed well below 100 mph, its wings can be swept forward to almost zero sweep. This high-performance airplane is intended to meet the Army's stringent requirements for a follow-on to the Grumman AO-1 Mohawk.

Boeing's disclosure of this design is expected to be followed in the near future by news of other variable sweep wing airplane proposals. Every major airframe manufacturer in the United States, England, France, Italy, Holland and Germany is known to be studying this new type of wing. A good indication of industry's general optimism is a statement by a Boeing spokesman, "Our research effort has been so extensive that we know more about variable sweep wings today than we knew about retractable landing gear when they were first introduced around 1930."

Most of the industry study effort has been directed toward three types of airplanes: 1) the supersonic transport of both the Mach 2 and Mach 3 varieties; 2) heavy, long-range interdiction aircraft to attack and reconnoiter deep in enemy territory; and, 3) smaller aircraft for close support of front line troops and/or battlefield surveillance. The requirements for all of these aircraft are so advanced that they probably cannot be met without using variable sweep wings.



Aircraft, shown in model form, will have wing sweep from approaching zero to more than 75 degrees for flight over 600 mph in turbulent air.

If present plans are carried through, all three of these aircraft types could enter development within a year. The English, French and U. S. governments apparently are going to subsidize the design and development of supersonic transports. The U. S. Department of Defense is interested in both types of attack aircraft, or if possible, the development of one airplane which can fulfill both missions economically. The NATO countries of Europe are initiating a design competition for a "light strike fighter" which would be used by all nations in the alliance. This aircraft will be a replacement for the Fiat G-91 which is now in NATO service and has been evaluated by the U. S. Army (see FLYING, April).

The advantages of the variable sweep are so impressive that most aeronautical experts in this country believe that the Russians probably will try to bring it into operation as soon as possible. Public information on the U. S. variable sweep effort has (*Continued on page* 124)

The pilot must adjust to the effects of age, but he will gain certain advantages as well

THE OLDER PILOT

By JOHN T. FLYNN, M.D.

THE RECENT Age 60 Rule for airline pilots, and the pressure to lower even this limit to 55 years, emphasized the toll that age inevitably takes on the skill and performance of every pilot. In some airmen, these deteriorations seem swift and all too obvious. Yet every pilot should be aware of the other side of the coin, for Nature is capable of surprisingly effective compensations for the loss of youth and quickness.

The earliest changes that the older pilot begins to notice are not physical ones. The absence of old bold pilots is in great part due to the fact that the bold pilot grows cautious with age. In fact most pilots who remain in aviation for a succession of years pass through roughly four stages of emotional attitude toward flying.

The first thrill of flying spurs the very young pilot toward a carefree attitude with little contemplation of the hazards. Secondly and gradually, accumulated experience, the mishaps of colleagues, increasing personal and domestic responsibilities sober the maturing pilot to a measured degree of caution. Thirdly, caution may expand into a controlled fear or distaste for flying, which the pilot may conceal entirely or may display through extreme attention to detail and an overcautious attitude. Last and most important is the eventual more fatalistic acceptance of the pleasures and hazards of the flying profession, tempered with proper caution and helped by the continual accumulation of flying hours and experience.

The bold pilot grows cautious probably in preparation for the aging of his physical capabilities, which usually begins in the late twenties and early thirties. The first of these changes is the decreased ability to handle certain bodily stresses, especially the increased difficulty in fighting off fatigue. A 30-year-old pilot found that after 24 hours without sleep on a typhoon reconnaissance mission he was reading his watch as an altimeter and entering altitude in the time column of his log. Five years before, he would not have believed himself capable of such an error.

As the same pilot nears 40, he is not able to withstand extremes of cold at altitude as he used to, because of decreased body heat production and lessened muscle activity. He finds a hot climate less tolerable as he grows older because of more limited dissipation of body heat through the skin.

A young individual generally can react quickly and strongly, where the older man reacts more slowly, less vigorously, and with less reserve for recuperation from stresses. Yet Nature's ability to compensate for these deficiencies is interesting to observe. For example, where the heart and circulation of a young man can make quick adjustments to extreme efforts for short periods, the slightly older human heart and blood vessels have an increased capacity for endurance which allows a healthy man of 40 to outlast a man of 20 in prolonged but less strenuous tasks. Today's astronaut in his late thirties is better equipped for the prolonged physical and mental tasks of his work than a man 15 years or more younger. The physical performances of men aged 50 to 60 in marathon races reflect this capacity for endurance, as well as the ability to capitalize on accumulated skill, long training, in addition to wide experience.

When exposed to decreased oxygen during rapid ascent to 14,000 feet, older resting individuals showed less change of pulse rate, had fewer complaints, and were less susceptible to fainting and collapse than younger persons. While rest and moderate exercise do not seem to put additional stress on the older human body, severe stress may quickly rob the older individual of his reserve of strength, forcing him to recuperate over a longer period than a younger man requires.

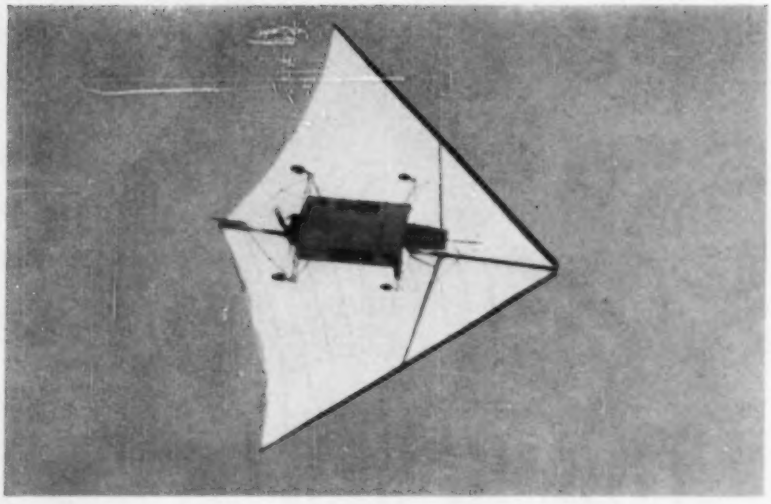
All the senses, especially vision and hearing, deteriorate in sharpness with age. The lens of the eye begins to harden in late childhood, though ability to focus on near objects is not seriously affected until age 40 on the average. In partial compensation for this, the eye becomes more farsighted, making it easier for the pilot to scan the terrain, the sky, and his landing area. Reading of instruments and controls overhead is more difficult, even with bifocal lenses, which necessitate tilting the head far back for proper vision of objects overhead. In addition, many older individuals begin to lose sharpness of focus for distant objects as well as near ones.

Generally, with age the width of the field of vision tends to narrow slightly, cutting down a little on the pilot's ability to see "out of the corner of his eye." Ability to judge distances correctly declines very slowly with the years, though almost never to an abnormal degree and only rarely interferes with the pilot's career seriously, providing no other serious vision difficulties are present.

The eye's adjustment to the dark undergoes considerable change with age, because (*Continued on page* 120)

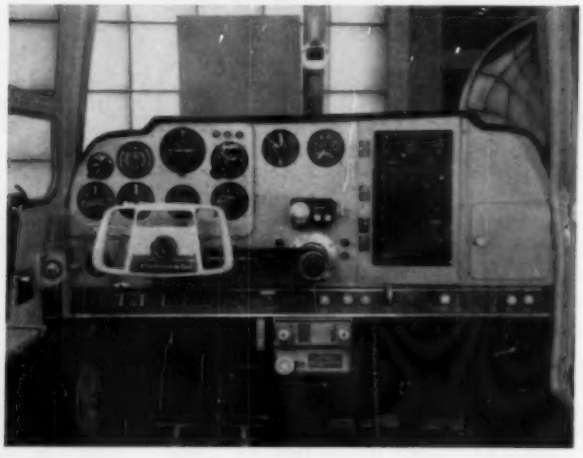
NEWSREEL

RYAN FLEX WING (*Right*). Overhead view of the kite-like research aircraft during test flight. The delta shaped wing is pivoted on a tubular structure, has a span of around 40 feet and is constructed of Mylar bonded to nylon. Aircraft is maneuvered by lateral and forward and aft tilt of the pivoted wing and is said to be very stable in flight. It is powered by a 180-hp Lycoming. The aircraft weighs 1,500 pounds.

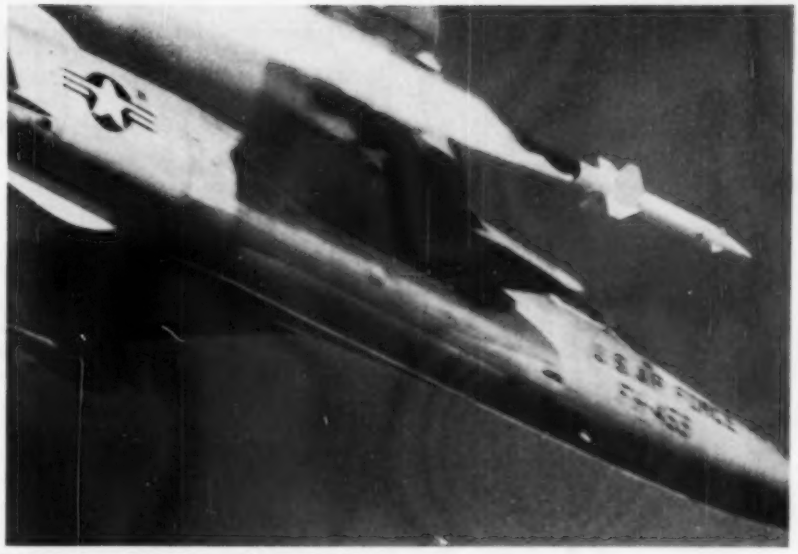


HUGHES 369 (*Below*). Latest rotary wing aircraft to join the competition for U.S. Army LOH (Light Observation Helicopter) is the four-place craft designed and built by the Aircraft Division, Hughes Tool Co. Bearing the military designation of HO-6, it is powered by an Allison T-63 turbine rated at 250 shp. Five helicopters will be delivered to Army Aviation Board, Ala.

1962 DEBONAIR (*Below*). Latest model of Beech's popular single-engine four-place airplane has a completely redesigned instrument panel with greatly improved instrument grouping and space availability. Fuel capacity has been increased to 78 gallons, giving a range of 1,135 miles. Top speed is 195 mph. Other changes consist of new interior styling and seats. Engine is Continental 1047-K rated at 225 hp.

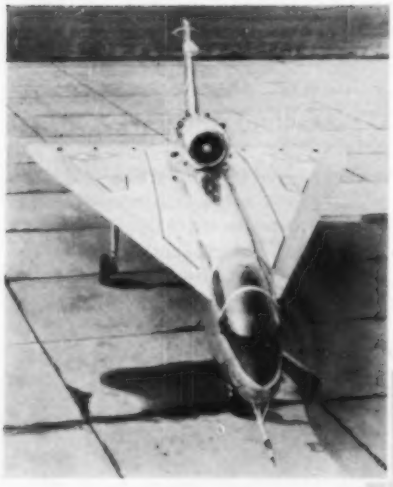


NEWSREEL

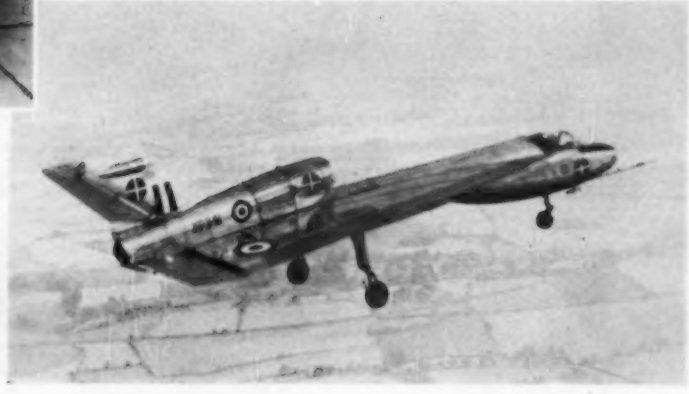


BULLPUP IN ACTION (*Right*). A recently released Department of Defense photograph shows a Martin GAN 83 Bullpup, air-to-ground guided missile, at the moment of release from a Republic F-105 tactical fighter. The missile travels nearly twice the speed of sound, and can be launched two miles from the target. Tracking flares enable pilot to follow its course, making directional changes by radio to target.

BOEING-VERTOL HRB-1 (*Left*). Military version of the Boeing-Vertol 107 which has recently won the U.S. Navy competition for Marine Corps assault transport helicopters. The aircraft will be equipped with powered blade folding system to facilitate storage on aircraft carriers and feature integrated loading which will permit loading of the helicopter in eight minutes.



CANADAIR CF-104 (*Above*). Built by Canadair Ltd. of Montreal under license to Lockheed Aircraft Corp., 200 of these versions of the F-104 Starfighter have been ordered by the RCAF to serve as ground strike reconnaissance aircraft. Six are now in flight stages with two undergoing tests at Palmdale, Calif. CF-104's G.E.J79 is rated at 15,800 lbs. thrust plus afterburner.



HANDLEY PAGE HP.115 (*Above and right*). British research aircraft especially designed to study the characteristics of slim delta wing in connection with the supersonic transport program. The aircraft is not supersonic as at the present stage of investigation slow-speed characteristics of the wing configuration are of prime importance. Span of the HP.115 is 20 feet, length 45 feet. It is powered by a 2,000-lb. thrust. Bristol Siddeley Viper turbojet.

It was no blarney the way this trio "smelt" their way across the Atlantic with smoke bombs and thermometers on the first westward crossing

The luck of the Irish

By MAJ. JAMES FITZMAURICE

Maj. James Fitzmaurice

IT IS ALL so very commonplace today. A pilot steps into a beautifully upholstered jet airliner, with an instrument panel equipped with every conceivable aid to navigation, at London Airport, and in a few short hours he is rolling his wheels on New York Airport. The result is that more people now cross the Atlantic by air than by sea, and we are still only on the threshold of civil air development, which is as limitless as the broad reaches of space itself.

But all that had a beginning in which I played a part, in 1927 and '28, on the then tough first westward crossing which was beset by the most formidable meteorological hazards.

As the weather blows up mainly from the west, our meteorologists were then simply grappling with the fundamentals of what is still a very inexact science, and knowledge of upper air conditions over such a vast stretch of water was unavailable, as weather ships were undreamed of. When you couple these facts with an airspeed of just over 100 mph, a water-cooled engine of 310 hp that was liable to pack up at any moment, and an instrument panel that to a great extent was a snare and an illusion, then you will have some idea of the job we tackled on this "Westward Ho!" lark in the roaring twenties. Just the same, it was all an immense amount of fun.

Civil air development, not to speak of flying the Atlantic, was still but a dream in 1913, when that far-seeing Anglo-Irish gentleman, Lord Northcliffe, offered a prize of 10,000 pounds "for the first person to cross the Atlantic ocean from any point in the United States, Canada or Newfoundland to any point in Great Britain or Ireland—or vice versa—in 72 continuous hours."

On June 15, 1919, Jack Alcock and Arthur Whitten Brown electrified the world when they crash-landed in a bog at Clifden on the west coast of Ireland, after a hair-raising flight of 16 hours 27 minutes from St. Johns, Newfoundland. They received the plaudits of the world, were knighted by His Majesty King George V, and Lord Northcliffe sat down and wrote out a cheque for 10,000 pounds, which represented around 40,000 pounds of the stuff we call money today

Owing to the financial stringency of the following decade, however, the development of flying equipment capable of facing up to the formidable meteorological hazards of the westward crossing could hardly be said to have been achieved. And until that undertaking had been successfully accomplished, transglobal civil air operation would remain but a dream.

In 1926 a New York financier, Raymond Orteig, offered a prize of $25,000 for a flight from New York to Paris or from any European capital city to New York. That prize went to Charles Lindbergh for his remarkable solo flight from (*Continued on page* 148)

Enclosed cabin of the metal Junkers sheltered the airmen from violent weather on the crossing. A sheep on the runway nearly ruined the takeoff.

There is a future for the inventor-pilot as he seeks to fly for the sake of flying, at the lowest cost

Igor Bensen and his Gyrocopter, one approach to the problem of low-cost flying for everyone.

Horizons in Private Flight

By IGOR BENSEN

THE POSSIBILITY that the aerial vehicle would become a customary tool of the private citizen after the manner of the automobile has proved a will o' the wisp during the first half century of flight.

The aircraft industry has made consistent efforts toward mass production although always compelled to work within rigid economic laws—show a profit or discontinue business. The citizen has met the industry halfway in his eagerness to attain private flight although he too has had to accept limited utilization and costs beyond his normal means in addition to demonstration of skills and judgements which taxed his capability.

Do these joint valiant efforts of the industry and citizen to realize a dream appear to have as limited a future as they have had a limited past? Will flight find its sole ultimate in commercial and military areas with a buffer ground of utilization in business flying, agriculture applications, prospecting, mapping, etc., or are wings for the citizen still a potential?

It seems to me the latter may have some foundation in fact if we shift our eyes from the status of aeronautics of yesterday to the status of aeronautics today and beyond. During the past 15 years the industry has produced a whole family of new types of flying machines, any one of which might eventually revolutionize the future of private aviation.

Starting with the helicopter developed first in the United States by Igor Sikorsky in 1939 and ending with GEM's (ground effect machines) developed under military contracts recently, there is a glittering new array of vehicles with great potential. While it is doubtful that they will supersede the conventional airplane, these newcomers do indicate horizons nonexistent only a short time ago.

Most of them have V/STOL capability. Only two types, the autogiro and helicopter, have joined the ranks of civilian aviation to date, but it is a foregone conclusion that others will be clamoring for recognition by the FAA in the not too distant future.

Let us first summarize what new frontiers have been penetrated and then see where and how they might have meaning to private aviation.

The new breed of V/STOL aircraft may be divided into two broad categories: (1) those with fixed propulsive and lifting surfaces, and (2) those with movable, or "tiltable", propulsive and/or lifting surfaces.

Each category has a large number of different prototypes which have been successfully flown, as reported in previous issues of FLYING. Some are still on the classified list as confidential military projects.

To the first category belong: helicopters; autogiros; convertiplanes with unloaded rotors (McDonnell, Fairey); "tail sitters" (Lockheed's Pogo Stick, Ryan's Vertijet, "Flying Bedstead", etc.); deflected slipstream V/STOL (Ryan, Fairchild); deflected jet craft (Bell, Short, Hawker-Siddley); buried ducted-fan craft (Vanguard, Piasecki, Avro-Canada, etc.); flying belt (RMI); flying platforms (Hiller, DeLackner, Bensen, Curtiss-Wright, etc.).

In the second category are: tilt-rotor fixed-wing craft (Bell, Curtiss-Wright); tilt-ducted-fan fixed-wing (Doak); tilt-jet fixed-wing (Bell); tilt (*Continued on page* 96)

NO. 258

I learned about flying from that!

After he zoomed up into the "thin" overcast to impress his audience, he found a few surprises waiting

By ROBERT A. CHALMERS

IN THE FALL of 1955 I was attached to an Airborne Early Warning (AEW) squadron at Naval Air Station, North Island, San Diego. Our detachment was training in AD5-W "guppy" radar planes for our first aircraft carrier deployment to the Western Pacific scheduled for the following month. In order to gain flight time and additional experience the pilots were encouraged to come in on weekends to fly extra hops.

The "guppies", with their several thousand pounds of delicate radar equipment and protruding bellies, were restricted to strictly bus-driver type straight and level flying with maybe an occasional 30-degree banked turn. However, the squadron did have two AD-4s or "slick-bellies" as we called them. To be able to schedule one of these unrestricted planes on a hop was a real treat for the frustrated "guppy" drivers.

On this particular Saturday morning I was lucky enough to be scheduled to fly one of the AD-4s. I climbed into the "slick-belly", took off and headed north from San Diego for several hours of just plain recreational flying and maybe a turn or two around Catalina Island. There was a broken overcast at about 1,000 feet over the ocean so I decided to take a low-level sight-seeing tour up the coastline. By the time I reached Long Beach I was really "feeling my oats" so I turned around to make a return trip and get a closer look at the fishing boats lying off the coast just south of Long Beach. I poured on 48 inches of manifold pressure and 2,600 rpm to get maximum continuous power out of the old "Skyraider" and dropped down on the water so I wouldn't have to look down at the people in the boats as I waved to them. After a few miles this became dull so I decided to break off my little low-level air show with a fitting "coup de grace". I would haul back on the stick, throw in a little right turn, punch through the thin overcast at about 800 feet, and soar up into the "wild blue".

With no further planning or thinking on my part I shoved the throttle and prop pitch to the firewall and hauled back on the stick. Upon entering the clouds, it didn't take long at the speed I was moving to discover that the "thin" overcast wasn't as thin as I had presumed. (I still have no idea where the tops of the clouds were that day.) Realizing that something had to be done, and fast, I initiated a frantic shuffling of eyeballs around the cockpit in an effort to find some flight instruments. Much to my surprise and horror the instrument panel looked completely foreign to me and the horizon line of the gyro-horizon, which I did recognize, was nowhere in sight on the instrument face.

I had had considerable actual day and night instrument time prior to this incident, but my time on the gauges had been primarily in AD5-W "guppies". The AD-4 instrument panel in front of me bore no resemblance whatsoever to the panel I had become so accustomed to scanning. Instinctively, I threw in some forward and left stick in an effort to right my unguided missile.

You did not hear about manned orbital flight and "weightlessness" in those days, but at that time I experienced this phenomenon first hand. I had pushed the stick forward just the right amount to give me zero "Gs". To add to the confusion the small bag in which I carried my oxygen mask floated up and poised in mid-air in front of me. I had experienced my share of vertigo prior to this flight but this condition made vertigo seem like a picnic. In common vertigo a sense of up and down is still present even if the sensed direction is wrong. The seat-of-the-pants feeling, although false, does give the pilot a certain feeling of security. It was quite another thing to have no clues whatsoever about my attitude.

Sheer panic gripped me and I had the sensation of being suspended inside a huge endless bowl of cotton by some mysterious force. Pictures of my AD-4 breaking out of the overcast at better than 300 knots straight down and the headlines "Navy Pilot Mysteriously Disappears at Sea" flashed through my head.

Of course all of the above took place in a very short period of time. At long last my searching eyes met two familiar gauges, one above the other—the rate-of-climb indicator and the needle-ball. The rate-of-climb was pegged at 6,000 fpm "up" and the turn needle indicated several needle widths right turn. It wasn't much of a job centering the turn needle but due to the inherent lag in the rate-of-climb indicator, several wild cycles of chasing the needle up and (*Continued on page* 140)

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THE THRUST LEVER

By CAPTAIN DAVE KUHN

How Safe Is Flying?

THERE WAS a time when aviation was not considered safe. Anyone defying the laws of gravity in a plane was considered some sort of a nut. Despite the fact that statistics now clearly indicate that flying is about the safest way to travel, some people still have a fear of getting off the ground. It is not uncommon, on a long glorious week end, to kill four or five hundred in auto mishaps, but these same people do not stay out of cars.

Possibly the best argument that flying is safe is an examination of the insurance companies' ratings. One can't argue with success. The insurance people, having amassed considerable funds, did not achieve that by taking on poor risks. They even lend money to airlines—which is a clue.

What about the risks to pilots? True, in the early days of flying a pilot could not buy insurance that covered airplane accidents. He had to be careful how he got killed (and passed to his reward) lest his bereaved loved ones be denied the solace of cash benefits. So they were careful and after a few years of actuarial scrutiny the insurance folks decided to provide them their choice of insurance with an aviation exclusion "rider" or a "rate-up" covering airplane mishaps.

Experience dictated that pilots were better risks than most people. They were careful and healthy. The "riders" were gradually removed and the "rate-ups" reduced by degrees until they finally disappeared altogether.

Today pilots may buy insurance at rates below the cost to the average citizen. This advantage is made possible by engaging in a group purchase plan.

Members of such plans can weather a pretty good storm.

Most airlines provide various group health, accident and life coverage. The rates are low considering what it would cost the individual alone. Should employment terminate (furlough, leaves, get fired), the insurances stops. One airline pilot heads a company that offers a $25,000 "Airline Pilot Occupational Disability Insurance" plan that will pay off after a year of waiting. It also is a group policy but cuts off at age 60 or when the individual no longer works for his respective company.

A Texas insurance company offers a $20,000 life insurance policy designed especially for pilots. The only qualification for participating is to possess either a first-class or second-class medical certificate from your FAA doctor. There is no requirement for employer-employee relation since the group is not confined to one airline.

Any surplus earnings of the company on all policies of this kind and class will be apportioned in dividends to the policy holders. For twelve dollars per month a pilot can have $20,000 in insurance with no strings attached. Of course the cost will be less with the (tax free) dividends.

I merely describe the above to show just what the sharp pencil boys in the insurance business think of the risks in flying. Certainly we do have hazards left. The point is they are less today than ever before, or else pilots could not get such a break in insurance costs.

There are many factors that have contributed to this added safety in aviation. We have better airport lighting, better navigational aids, better approach procedures, better help from the ground (traffic control and radar advisory) and yes, better regulations than when man first took to the air. Probably the greatest contribution to safety is the wonderfully dependable jet airplane. It is built like a brick and goes like a streak. These improvements in safety just did not happen. They are a result of dedicated effort of everyone concerned with the art. A big slice of credit goes to the manufacturer and we pilots also claim a share. Since we ride in the nose we hold a vested interest. If we get the nose there safely, the rest of the ship is apt to arrive likewise.

While there are many people still leery of taking to the air, they have only to look around an airport terminal to realize that insurance people hold no such qualms. For 25 cents, a slot machine will issue an air traveler $6,000 worth of trip insurance —this with no evidence of good health. While most pilots are loaded with insurance, we hope to make the underwriters even more wealthy by never collecting on it.

Gen. Douglas MacArthur once quoted a line, "Old Soldiers never die, they just fade away." I hope I will be forgiven if I corn it a bit with, "Old Pilots never die, they just look that way."

At least the insurance companies will gamble on it.

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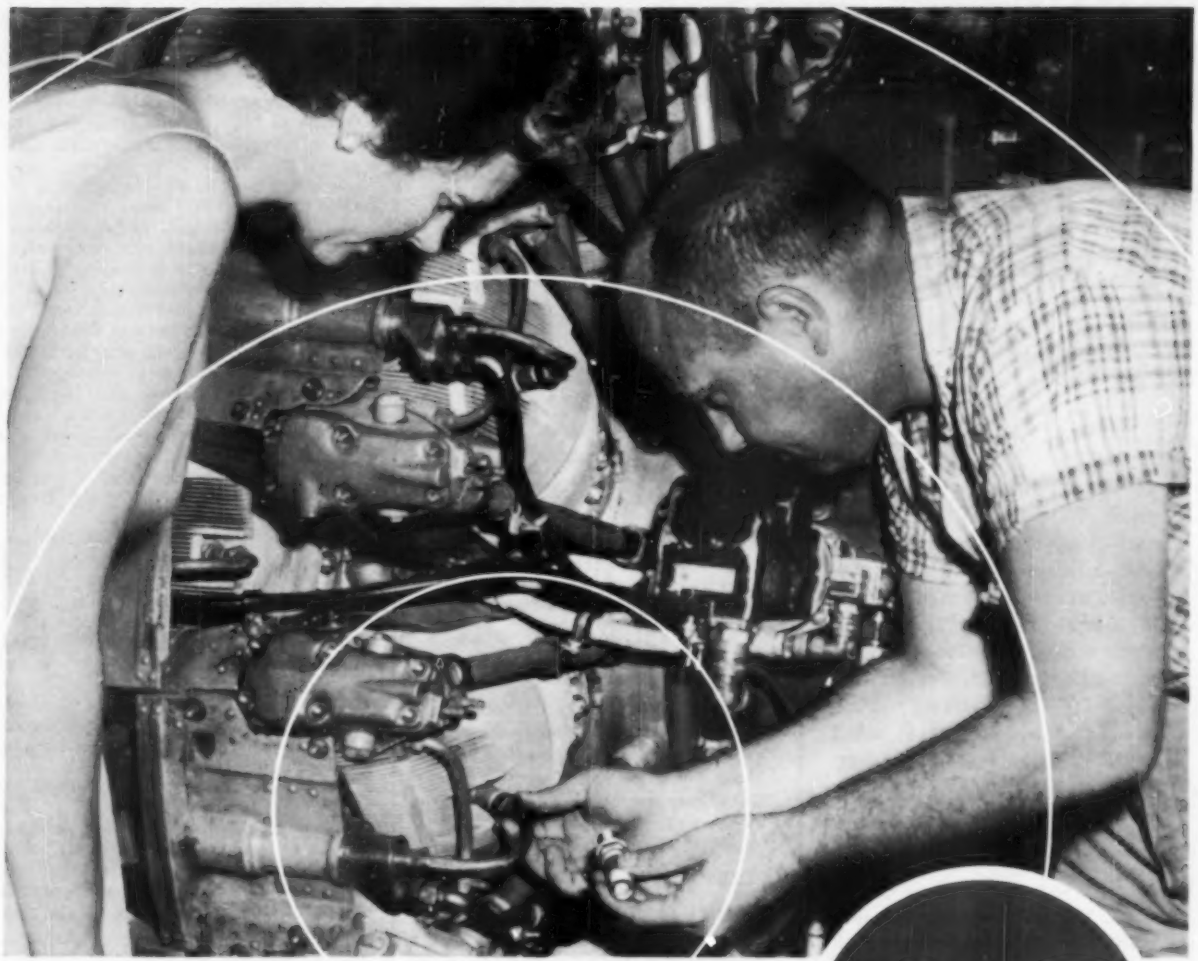

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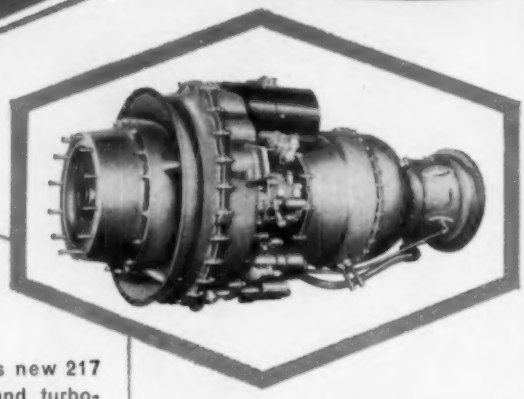

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Canadair CL-41

(Continued from page 51)

throttle was pushed suddenly forward, taking about one second to move from idle to full power. The JT12's light compressor responded to throttle almost as well as a conventional engine; there was just a four-second lag before the engine rpm was steady at 95 per cent, which is being used to give a full-throttle power of 2,400 pounds thrust. The engine has been "derated" from its 3,000-pound thrust capability by a mechanical limit on the engine fuel control in order to prevent introducing the student pilot to an excessively high-performance airplane, to place a comfortable margin between cruise airspeed and limiting Mach, and to allow longer time between overhauls. Time between overhauls now stands at 800 hours, and is expected to go to 1,000 hours in a year.

Instruments checked, brakes were released and the airplane, at a gross weight of 7,140 pounds, began to accelerate. Rudder is effective for directional control at 40 to 45 knots. The nosewheel was off the runway at about 85 knots and the airplane was airborne at 95 knots, after an 1,800-foot takeoff roll. Landing gear was retracted, and at 125 knots the 25-degree takeoff flap was retracted, without noticeable sink. Gear doors, speed brakes and intake screen, as well as gear and flaps, are hydraulically powered. Screen position is controlled by the position of the landing gear handle.

Our initial rate of climb was 3,200 fpm. The CL-41 uses a standard USAF B-8 control stick grip, topped with an electrical aileron and elevator trim button. Freeborn flew the airplane for a moment, trimming it into its climb at 180 knots. Then, hands off, he turned to me and discussed aircraft stability. The '41 flew on without a quaver in its flight path for several minutes, a trick that sounds commonplace but is not easy to perform in single-engine jet aircraft.

Turns were not quite so unusual as you would expect from the side-by-side seating, and after a turn or two, it was not difficult to maintain altitude through turns in both directions. Cabin pressurization begins at 8,000 feet, and maintains three psi differential between cabin and outside pressure.

At 10,000 feet the '41 was climbing at 2,500 fpm, and we levelled at 15,000 feet among the tops of scattered cumulus, off airways.

First came the stalls. Gear and flaps up, the airplane was held in a slight nose-up attitude and power reduced to idle. At 85 knots there was just a hint of a warning; at 84 the airplane stalled. The '41 has one of the most sudden stalls of any airplane this editor has flown. Conversely, though, just an inch of forward stick snaps the airplane immediately out of its stall. You can stall and recover the airplane almost as if the control stick were an electric switch flicking the stall on and off. Production models of the trainer will have a stick-shaker stall-warning system, which might well be appreciated by the student pilot. With gear and flaps down, the stall comes at 74 knots with a little more buffet. Since the airplane carries all its

(Continued on page 84)

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(Continued from page 82)

fuel in one fuselage tank at the airplane's center of gravity, there is no asymmetrical loading to change stall or spin characteristics as fuel is consumed. Although the little trainer carries only one third the fuel load of a Lockheed T-33 trainer, its smaller engine allows a comparable maximum endurance of two and a half hours.

Gear and flaps up at 16,000 feet with 85 per cent rpm resulted in 205 knots on the airspeed indicator, for 262 knots true airspeed.

The '41's response to control pressure is surprisingly quick and definite, and the Canadair pilot rapidly forms a strong friendship with his airplane. Flight controls operate through servotabs; no hydraulic boost system is necessary to make the controls as light as they are. If there is one feature that is most outstanding to the pilot of this airplane, it is the excellent control response.

Barrel rolls were flown to the left and to the right. At 250 knots the airplane described an effortless circle around the point chosen on the horizon. Aileron rolls were child's play; with full stick travel to the left we rolled without the breathtaking speed of a big fighter airplane, but still quickly enough so that there was no tendency to mentally urge the airplane around the roll that many lower-performance acrobatic and training airplanes invoke.

Loops posed a problem. At 350 knots with the nose lifting through the horizon, the stick was pressed back to give a three to four G flight path. Most pilots have flown acrobatics in tandem aircraft only, and will seek to keep the wings parallel to the horizon by looking from one wing to another. With side-by-side seating, this method doesn't work. You can see the left wing normally, but the tip of the right wing is visible only by leaning forward slightly in the seat. The unbalanced view made this pilot feel as if he were trying to loop a DC-6, and we come out of the maneuver considerably askew. The next loop was somewhat better, but still I felt that the only way to do a perfect loop was to fly by the attitude indicator.

Immelmanns were simple, and we rolled out on top with 130 knots on the airspeed indicator; 45 knots above a stall. The controls responded very nicely and there was no hint of mushiness.

For a check on spin characteristics, we spun to the right, with the direction of engine rotation. Left spins are very difficult to enter without extreme nose-high attitudes. One spin was attempted with the nose a few degrees above the horizon. With full aft stick and right rudder, the '41 simply swooped down to the right. The next attempt put the nose 30 degrees above the horizon, and the entry was very positive. Holding hard right rudder and full aft stick against a heavy buffet, we spun rather slowly down. The first half turn was steeply nose down, then the nose rose smoothly almost to the horizon and paused, in a moment dropping down again and to repeat the cycle. To recover, I pushed full left rudder. The rotation increased for three-quarters of a turn, and I moved the stick sharply forward. My overzealousness resulted in half a negative G on the accelerometer and a recovery dive that pointed straight down. Turning airspeed into altitude, we levelled at 14,000 feet and one more spin was completed, with a less alarming recovery.

Canadair design engineers made many modifications to the empennage to give the aircraft first the capability to spin and then to give it good spin characteristics. Result is a very deep vertical stabilizer and high-mounted horizontal stabilizer, which, incidentally, is never blanked out by the wing in acrobatic maneuvers. In flight tests, the CL-41 has been spun from 37,000 feet to 7,000 feet. It was discovered that the oscillation is only a factor in lower-altitude spins; the trainer spun smoothly and evenly down to 20,000 feet.

At 12,000 feet, we rolled inverted and tried a split-S, pulling back the speed brake switch on the top of the throttle as the nose passed through the horizon. In this maneuver, as in level flight, the speed brakes do not make a great deal of difference in the airplane flight characteristics. Level at 6,000 feet, the speed brakes were opened while flying the airplane hands-off at 250 knots. As the brakes came out, there was a very mild rising of the nose that took just one touch of forward trim to overcome.

CANADAIR CL-41

Specifications:

Maximum takeoff gross weight	7,200 lbs.
Wing span	36 ft. 4 in.
Length	32 ft. 0 in.
Height	9 ft. 8 in.
Fuel capacity	1,950 lbs.
Baggage capacity	20 lbs.
Engine: Pratt and Whitney JT12, limited to 2,400 pounds thrust	

Performance

(Gross weight):	
Limiting airspeed	Mach .8
Maximum level flight TAS (30,000 ft.)	412 knots
Range	750 naut. miles
Stall speed (gear and flaps up)	84 knots
(gear and flaps down)	74 knots
Initial rate of climb	3,400 fpm
Service ceiling	44,500 ft.
Takeoff distance	1,300 ft.
Landing distance	1,400 ft.

The tower at Cartierville was still calling the winds from the west at 25 knots when we entered the pattern for runway 28. At the civilian airport a conventional landing pattern is used, and with speed brakes out, gear is lowered by touching the landing gear lever down at any speed less than 180 knots. In eight seconds the selsyn indicators showed three wheels, the red light in the gear lever handle was out, and the warning tone in the earphones was quiet. The fourth check for locked landing gear is a light in the small plexiglass nosecone. If the light is on, the tower or mobile control officer knows that the landing gear is locked. The flap switch was moved to "takeoff" and we turned to base leg, holding 135 knots. Final approach took 115 knots and full flaps (40 degrees). Throughout the pattern the little

(Continued on page 90)

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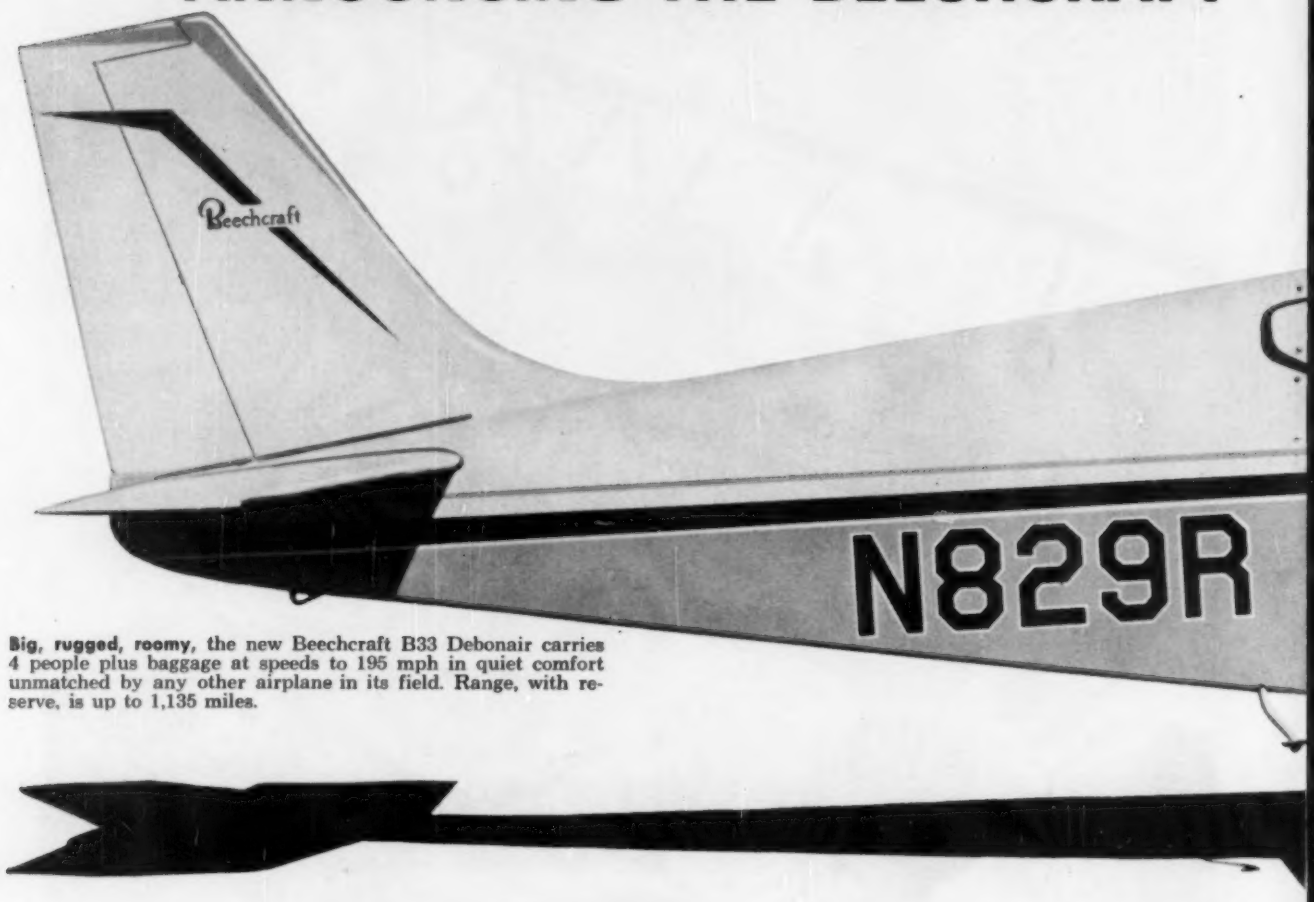

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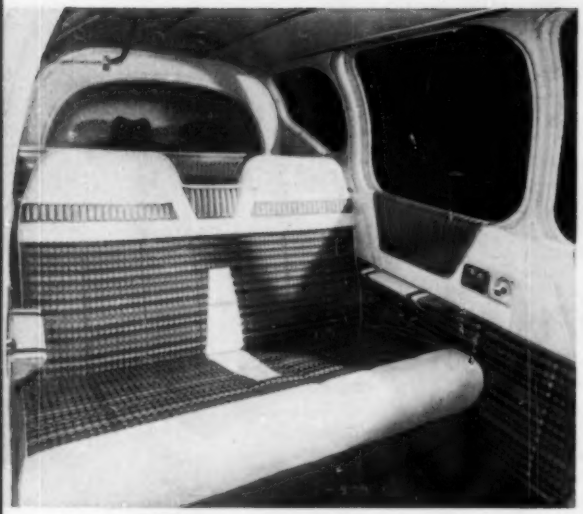

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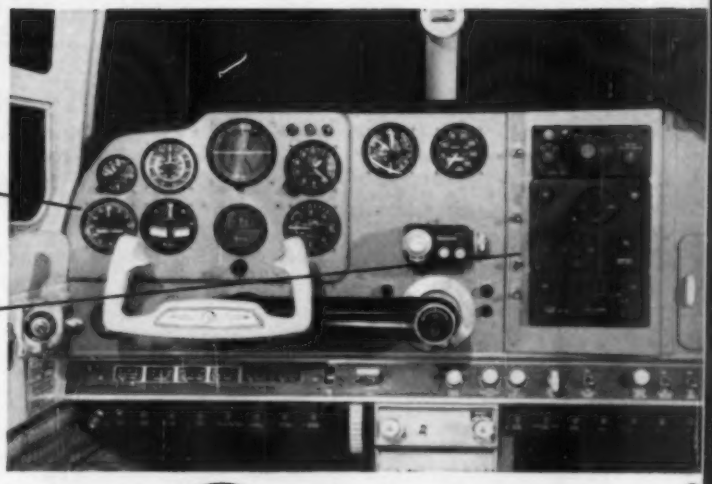

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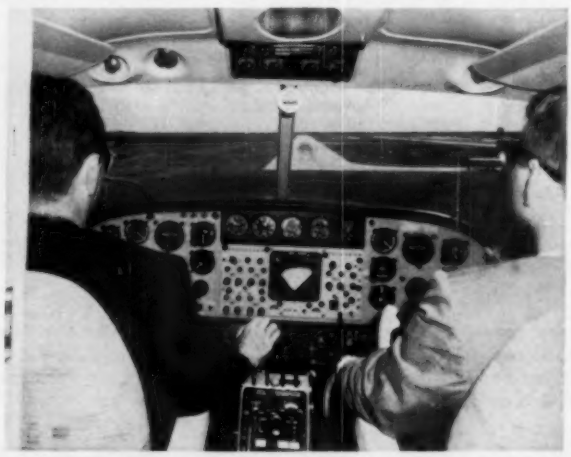

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UNITED AIR LINES

(Continued from page 84)

airplane gave an excellent feel of presence and of being under complete control.

An airspeed of 105 knots over the fence worked nicely, even in the rough air. At about 95 knots we touched the runway with a jolt. Not one of the four landings flown with the airplane was as smooth as I would have liked. The '41 has rather stiff landing gear struts, and unless the pilot flies his airplane precisely to the runway, he will not find himself making perfectly smooth landings. A good Canadair pilot, however, will have no difficulty making smooth landings in military fighter aircraft.

The go-arounds emphasized again the rapid response of the JT12 to its throttle. The '41 can make a safe go-around, climb-out, and pattern entry with landing gear, full flaps and speed brakes out; a maneuver that can be somewhat dangerous for the untrained pilot in heavier aircraft. The fuel low-level warning light came on with 500 pounds of fuel remaining, one quarter of a full load and enough for about 30 minutes of flight at low altitude.

Our next landing was a full stop, and we braked to a halt in about 1,000 feet. The brakes are independent of the main hydraulic system, and are quite positive.

Shutdown, back on the Canadair ramp, was simply a matter of throttle off and turning off radio and master switches.

At that moment, far from being the objective check pilot, this editor was ready to buy a Canadair 41 simply for its excellent performance as an airplane. Had he done so, it would have been with the full agreement of his maintenance supervisor, for the little trainer has over 50 access doors at strategic points, and more than 90 per cent of the airplane can be reached without ladders or stands. Virtually the entire lower fuselage opens in a series of piano-hinged doors for access to the engine and to divided tunnels for electrical wiring runs and hydraulic lines.

The fuselage break line is just aft of the wing trailing edge, and the aft fuselage is easily removed for engine changes. The engine compartment is roomy enough to allow the installation of any of three other engines, if the customer desires, without major modifications; the Armstrong-Siddeley Viper (2,460 pounds thrust), the General Electric J85 (2,500 pounds thrust), and the Rolls-Royce RB-145 (2,570 pounds thrust). There has been recent talk of fitting the $200,000 aircraft with a RR/MAN 153 engine, derated from 4,000 to 3,200 pounds thrust.

In all, the light trainer is an airplane admirably suited to its purpose. A further development of it is the CL-41R advanced systems trainer, designed especially for pilot training with the F-104G radar package, soon to become widely used in Europe.

Recently returned from an overseas tour, Canadair's gamble could very well result in the simplest, most responsive jet trainer in many an air force. END

Light Twin Proficiency

(Continued from page 57)

speed (gear and flaps up), and then maintain this speed in straight and level flight by applying power. After developing positive control over the aircraft at the minimum speed, start making shallow turns to the left and right; maintain altitude and a constant airspeed.

Later in the maneuver, lower flaps to varying degrees, and lower and raise the gear. Use power to keep altitude and airspeed constant. Remember to use smooth pressure on the flight and engine controls. A smooth technique permits the development of a more sensitive feel of the controls with a keener sense of an approaching stall.

Go-around: Procedures vary with different makes of twins depending upon their weight, flight characteristics, flap and gear retraction systems. For a particular airplane, reference should be made to the owner's manual. However, there are several general principles which apply to most airplanes such as:

1. At least cruising power should be applied immediately when a go-around decision is made.

2. The gear should be raised only after the descent is stopped.

3. Takeoff or climb power should be applied as soon as the trim change to "climb setting" has been made.

4. Flaps should be raised slowly in accordance with the manufacturer's recommendation. They should remain in the takeoff position until clearance of all obstacles is certain. For example, the recommended procedure for the Cessna 310 is to reduce the flap setting to 10 degrees for the climb-out. Once all obstacles are cleared, and a safe altitude and airspeed is reached, then flaps may be retracted all the way.

Keep in mind that the two basic requirements of a successful go-around are the prompt arrest of the descent and the establishing of the best climb airspeed.

Another point to keep in mind is that any time when the airspeed is higher than the flaps-up stalling speed, flaps may be retracted without losing altitude if the angle of attack of the wings is increased sufficiently. At critically low airspeeds, retracting the flaps suddenly can cause a stall or pronounced sinking; rapid retraction of flaps when close to the ground on a go-around should be avoided. It will generally be found that retracting the flaps half way or to the recommended "takeoff position," decreases the drag a relatively greater amount than it decreases the lift.

The oblique circuit: This exercise (see diagram) is one in rapid descent and pull-up. Fly it on a VFR day with at least five miles visibility and a ceiling high enough to allow the start of the maneuver at an altitude of 5,000 feet. Slow the airplane down to the normal holding airspeed and maintain altitude, airspeed, and heading for one minute.

At the end of that time, reduce manifold pressure and start a standard rate descending left turn to 4,000 feet, maintaining holding airspeed by use of the elevators.

Continue the turn until the course has been reversed, and roll the wings to the level position. At 4,100 feet, begin to add sufficient manifold pressure so that the holding airspeed can be maintained when the aircraft is leveled off at the bottom of the circuit.

For the next minute fly straight and level

(Continued on page 92)

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(Continued from page 90)

on the reverse course, then add climb power and start a climbing standard rate turn to the left, maintaining the same holding airspeed. Level off exactly at the original altitude and retard power to maintain the same airspeed used throughout the circuit.

Then repeat the oblique circuit, this time making the descending and climbing turns to the right.

Check yourself on:

1. Maintaining the airspeed with five mph throughout the maneuver.
2. Holding a constant bank (within five degrees) during the climbing and descending turns.
3. Ability to level off without passing the original and minimum circuit altitudes.
4. Holding the heading within five degrees and the altitude in level flight within 50 feet.

Single engine operation: This exercise also should be practiced on a VFR day, with at least five-mile visibility, at an altitude 3,000 feet or more above the ground, and within gliding distance of an airport which can accommodate a twin.

Most important in an engine-out situation is to determine quickly which powerplant has failed (the co-pilot may pull the mixture control or retard the power.) If an engine fails in level flight, the aircraft will yaw toward the inoperative or idling engine, and it usually takes heavy opposite rudder pressure to hold the aircraft straight and level. Hence the saying, "Idle foot, idle engine" can be used to aid the pilot in determining which engine has failed.

The situation is a little more difficult though, in a steep turn when the bottom engine is cut. The good engine on the high side will tend to further raise the wing. This will tighten the turn unless the aircraft is rolled out of the turn as soon as an engine-out situation is detected. And once straight and level, the malfunctioning or the zero-thrust engine can be determined.

After following the procedure recommended by the aircraft manufacturer for an engine-out situation, check yourself on the following:

Was the inoperative engine quickly identified?

Was the correct procedure followed when calling for gear and flaps up?

Were the throttle and prop controls set properly on the operating engine?

How well were direction and altitude held, while paying proper attention to attitude and airspeed?

Was the proper technique chosen to establish the best engine-out climb?

Were oil shutter and cowl flaps properly adjusted?

Was the proper unfeathering procedure followed and was the restarted engine warmed up before the throttle was moved back to give the normal power?

It can be seen quite readily that in any in-flight emergency situation, judgment and precision are more important than speed. A wrong move in a delicate situation can cause more serious trouble than the moment or two you spend to figure out and execute the right move. Having well-established, proper procedures for in-flight problems, and possessing the proficiency to apply them will increase your confidence in your ability to handle any flight problems that come your way. END

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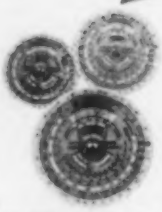

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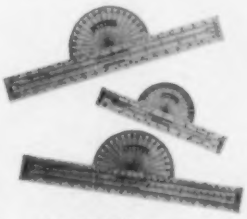

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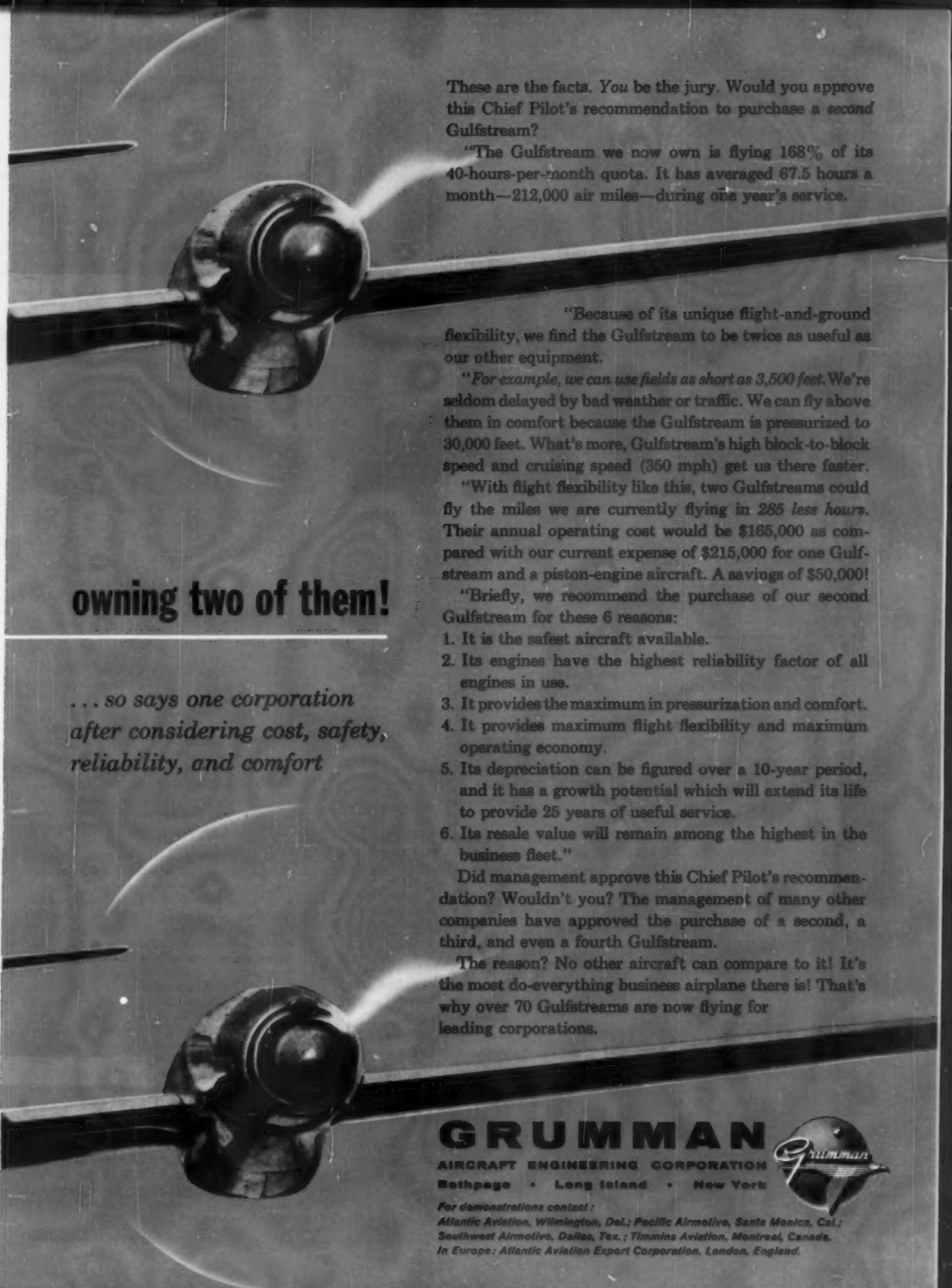

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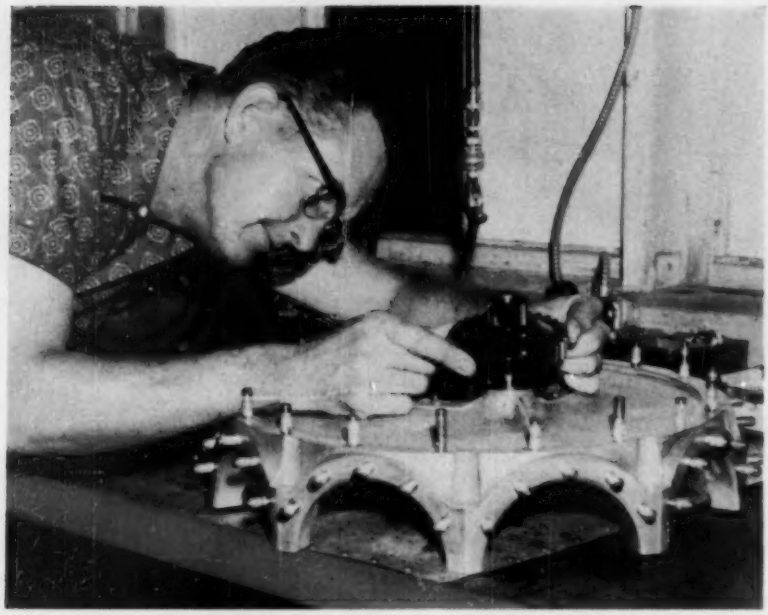

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Horizons in Flight

(Continued from page 77)

rotor and wing aircraft (Vertol, Hiller).

No doubt, there are other combinations still in experimental stages not yet reported to the public. This is an impressive lineup considering the fact that all listed have already been aloft. Never previously in aviation history have there been so many new configurations or so much freshly acquired knowledge concerned with flight near and at Mach zero. In this recent volume of knowledge may well be hidden the magic ingredients that some day will make a flying machine as common as an automobile.

A utopia? A fantasy? No more fantastic today than seemed shooting rockets to the moon only 10 years ago. At today's pace in technology, citizen wings may become reality in a wink of time.

Invention has changed the face of civilization more swiftly than all social and economic reforms put together. What would society be today without electricity, motor power, airpower, modern chemistry? Yet, these forces are less than 100 years old—a mere moment in the history of mankind.

As one of those engaged in business experimenting with the new knowledge available in aerodynamics, I have consistently sought to recruit embryo inventors to participate in this area. I cannot help but believe that the counterparts of the Wright Brothers, the Sikorskys, the Glen Curtisses, et al, are waiting challenge in this day even as those giften men awaited it in their day. Nor is our confidence disappointed.

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Already the results have been productive. Gyrocopters have been built and experimentally flown as spare time projects by a great variety of qualified people.

Ideas and theories are most valuable when they lead to experiment. It is not enough to dream, speculate, plan, and argue about an idea. It must be subject to the test of reality. Failures, as well as triumphs are steppingstones to success. In the practice of inventing, 10 "duds" to one "hit" is an enviable record.

In all this drama of evolution of new embryos of potentially great flying machines, it is the viewpoint of the writer that the most will be accomplished as the most are challenged to participate; as the incentives are broadened; as opportunities are offered; as encouragement is given to try.

Certainly at this critical time in civilization when technology seems to play such a decisive role in the conflict of the ideologies, a floodtide of incentive to invention must be opportune to the philosophy of human freedom. END

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Ag Flying

(Continued from page 53)

experiences for the novice and so-called professional alike. This high accident rate is largely due to the self-trained air applicators. Proper training in this business pays off! This has been proven by the record of the nation's only full time "Ag" school, the Agricultural Aviation Academy, of Minden, Nevada. The school has been training "Ag" pilots since 1958, and not a single graduate in over 150 students, has been hurt while flying as a crop duster pilot.

Few pilots fail to realize that this kind of flying is actually no more dangerous than most other phases of aviation, but as long as this misconception exists, there will always be an abundance of jobs and opportunities for those engaged in the industry. The author will attempt to debunk, in the following, many of the fallacies associated with this subject and attempt to clear the air on a few of the vital factors concerning this little known subject:

FALLACY: Low flying and close to the ground air maneuvers are highly dangerous.

FACT: This is true to a degree, but on the other hand most "Ag" work is done over flat terrain with many of the obstructions encountered on approaches to some airport runways. In any event, a pilot should use his eyes and common sense. It is not the low flying that's dangerous, but the lack of knowledge of how to properly execute attitude flight control by visual reference to the ground without instuments. Reaction and speed sense also plays an important role, where mechanical pilotage has definitely no place. Actually, few accidents occur as a result of low flying during swath runs. Tight and dangerous turns are the causes of most "Ag" accidents. These maneuvers are not necessary to do the job properly and speedily, as all well trained "Ag" pilots realize. Time is not saved while in the air, but in ground-loading operations. Inexperienced and careless pilots attempting to save scant seconds by hurrying through the turn invariably will make too tight a maneuver and stall the aircraft close to the ground. This, unfortunately, has been the most predominant cause of flying accidents involving "Ag" pilots in the past. Actually, the difference between a normal safe flying turn and a sharp dangerous one, is only a matter of five or ten minutes difference during the course of a normal working day.

FALLACY: Agricultural chemicals are highly dangerous to the touch and when inhaled.

FACT: Chemicals are all alike. Some are toxic and some are non-toxic. Every known brand of agricultural chemicals can be handled with complete safety, without ill side effects. All one has to do is follow the clearly printed instructions on the label of every container holding agricultural chemicals. Also, there are printed instructions in the event of accidental poisoning and the antidotes to be used in this event. Face masks, gloves and respirators are always available for safe and easy handling of the chemical. Today's modern "Ag" airplane is so designed that chemical sprays and dusts are dispensed well aft of the cockpit with no chance for the residues to infiltrate inside. Reinforced hoppers, tanks, and beefed-up structural designs eliminate any chance of being doused by the chemicals in the event of an accident. Inflammable chemicals such as sulphur dusts are no longer used, and this has also greatly minimized the dangers.

FALLACY: "Ag" airplanes are flying contraptions held together with bailing wire and are unfit to fly.

FACT: Nothing could be further from the truth! In most cases, "Ag" aircraft are in a better airworthy condition than many a private airplane. Most operators rebuild and rejuvenate their craft every year or two prior to the opening of the season. These airplanes must be in top mechanical condition, else revenue can be lost by tieing up a badly needed airplane during the peak of the season. A single day's loss of the aircraft due to repairs could mean $1,000 loss in gross revenue to the operator. Special attention has been paid in modern agricultural aircraft to the protection of the pilot in the event of crash. The forward fuselage and cockpit area is reinforced and designed to absorb energy and collapse progressively. The instrument panel is free of sharp and rigid edges in the range of the pilot's head and will absorb a shock with minimum damage to the head. Safety belt and shoulder harness are extra strong, anchored directly to structural truss points. The shoulder harness is provided with an inertia reel.

FALLACY: "Ag" pilots are required to be experts in chemicals, entomology and farming.

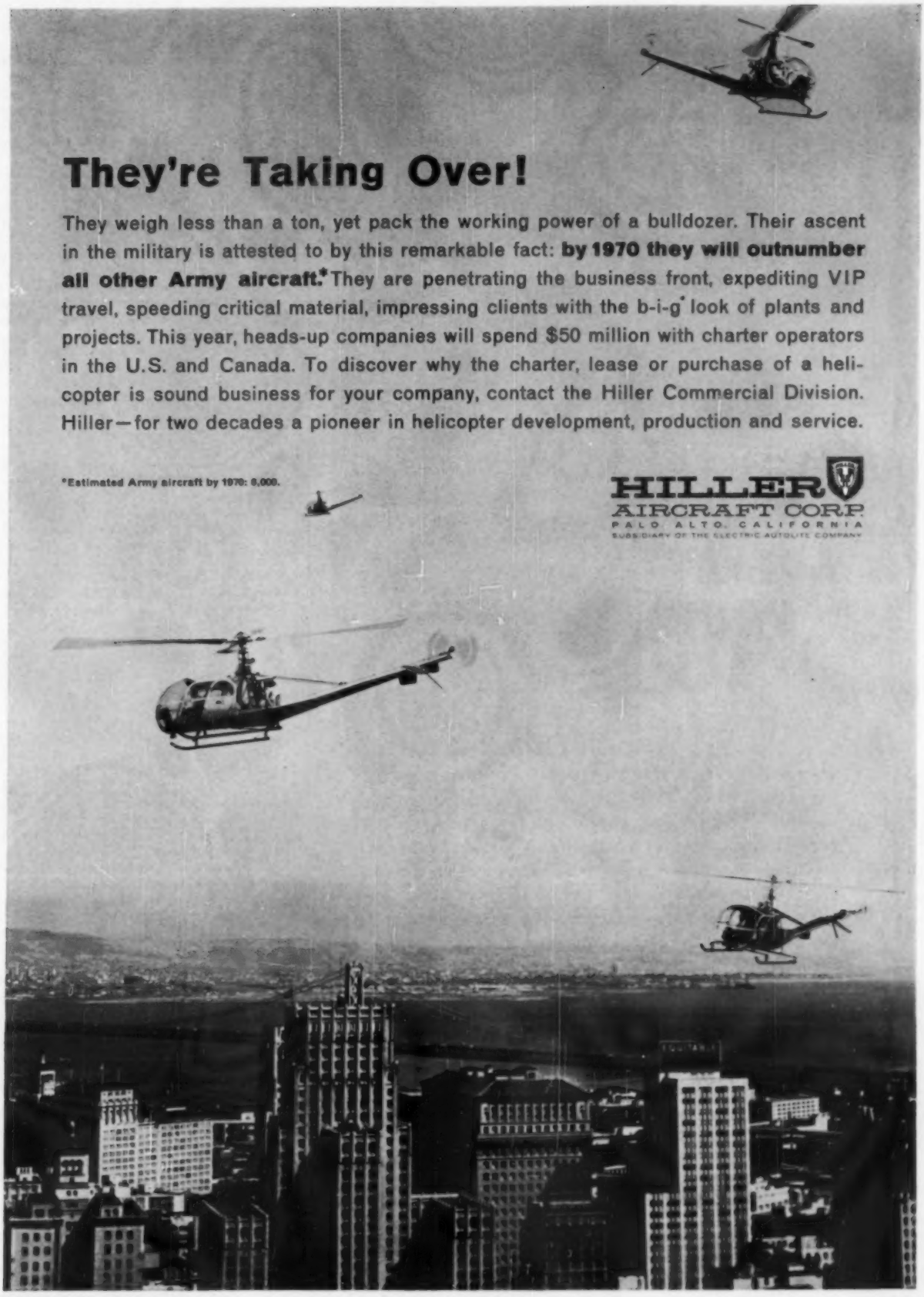
FACT: This misconception exists by those lacking understanding of "Ag" pilot duties. An air applicator is what the term implies. "To apply various elements to crops." It is not essential for him to be a farmer, chemist or an entomologist. He first must be a competent pilot and know how to calibrate the areas of work and to determine the best and most efficient methods for applying the loads. Safety in conducting these operations and avoiding damages to adjacent crops are close seconds. Lastly, he must have a reasonable understanding of recognizing the various crops from the air.

When it comes to bugs and chemicals, usually, the local agricultural extension agents, chemical salesmen and farmers will determine the type and quantities of ingredients to be used. It is to an "Ag" pilot's advantage to know these subjects, but not a necessity.

FALLACY: "Ag" pilots are employed for comparatively short periods of time each season. Most "Ag" pilots are of the nomad vintage; are daredevils and are a loose ill-mannered and poorly attired group.

FACT: These impressions are inaccurate. The term daredevil is misconstrued from the courageous pioneers of over two decades ago when "Ag" airplanes were mostly home-made contraptions held together with bailing wire. These men were not only pilots, but were home grown aeronautical engineers, farmers, bookkeepers, bill collectors, salesmen, chemists and what have you. Since this crude and little known era of agricultural aviation, great strides have taken place in the industry. Major aircraft manufacturers are producing airplanes exclusively designed for agriculture. New

(Continued on page 102)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Continental Motors Corporation

AIRCRAFT ENGINE DIVISION . . . MUSKEGON, MICHIGAN

(Continued from page 100)

and revolutionary chemicals have been discovered for easy handling, and methods of application have become a science. An "Ag" pilot may be either a nomad or a stay-at-homer as there is plenty of work for both. Since the advent of the newly manufactured low operating cost "Ag" aircraft, "Ag" aviation is now in competition with ground operators.

In addition, aerial application is now a cheaper and speedier method as airplanes will not trample valuable crops while doing the job.

The seasons for air applicator work has doubled and tripled in recent years as more phases have been added to the already rapidly expanding industry. Now under the heading of aerial application, in addition to crop work, is borate dropping for fires, mosquito control, sagebrush removal, forest cultivation and other numerous operations. Seasons run concurrently the year around the world over. North America's maximum season usually lasts from February to November, while Australia, Central and South America's seasons are at their peak during our winter months.

Employment prospects for "Ag" pilots outside of agriculture are excellent. Many flight operators in addition to conducting "Ag" operations also sell airplanes, give flight instruction, operate air taxi and charter services, are contractors in industrial flying and many other flight activities. These firms will give preference to pilots whose abilities are not limited and especially so in the most lucrative and important phase, aerial application. In fact, most operators prefer hiring a low-hour pilot possessing "Ag" experience to a veteran pilot without this background.

The foregoing fallacies are a few of the most common among the average pilots. This article is not intended to minimize, or rule out the hazards or the intricacies of "Ag" flying, but to point out some of the misunderstandings that have been prevalent in the industry since its inception. The work is not altogether easy and a pilot must expect to get his hands dirty. There will be times when the only rest he will get is in between the loading operations, and even then he will remain in the cockpit while the ground crews load.

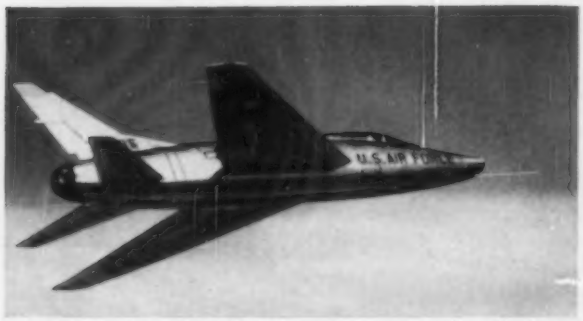
In most cases, operations are conducted in the early morning hours, when the air is heavy, calm and smooth. The "Ag" pilot must be an early riser. Heavy air is essential to good lifting qualities and safe altitude control close to the ground. There must be little or no wind as chemicals will drift great distances into unwanted areas and can result in lawsuits because of adjacent property damage to crops, livestock, bees, etc.

Unstable warm and soft air is definitely hazardous in "Ag" operations.

The rewards are definitely there for the air applicator pilot. "Ag" flying is civilian aviation's best paying industry and will continue to be so as long as less than one percent of the total pilots enter this growing field. Agricultural aviation has only scratched the surface as yet and as long as there is a need for more food to feed the exploding populations of the world and greater crop yields are required, there will be a good many golden opportunities for "Ag" pilots. END

REPORT:

Shell reports on three new lubricants that improve aircraft operation—and two new developments that improve aircraft service



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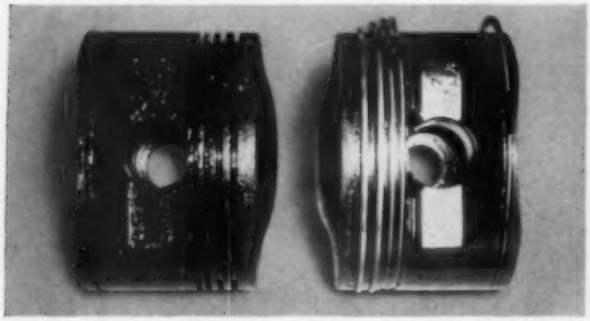

First non-ash dispersant oil. These pistons were pulled from engines of same aircraft after 1000 hrs. Left piston used straight mineral oil. Piston on the right used AeroShell Oil W. Additives in Oil W are 100% metal free.

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Above: At the Service City information bureau, VARCO Captain Geoffrey Murray (right) and mechanic Eduardo Bello learn facilities available.

Above: Overhaul of the VARCO Beechcraft Super 18's Hartzell propellers is discussed with the Southwest Airmotive Company's overhaul foreman.

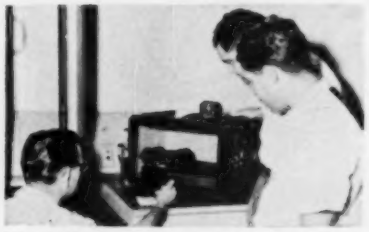
SERVICE CITY U.S.A.

A CITY of specialists has been formed at Love Field, Dallas, Tex. Southwest Airmotive's Service City, population 810, elevation 485, consists of five major companies specializing in aircraft service and offering one-stop repair and maintenance at one location (see photos). Service City also offers itinerant pilots a complete aviation supply warehouse, Cessna distributorship, aircraft charter and lease, a restaurant and rental automobiles. Pictured here is a crew from the Venezuelan Atlantic Refining Company; first aircrew introduced to the City and its services.

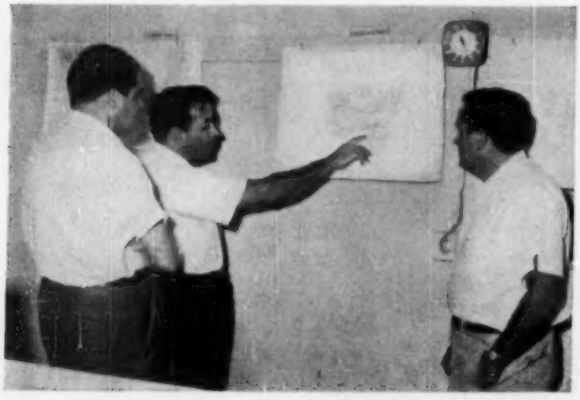
Above: Capt. Murray discusses airframe overhaul with Executive Aircraft Service official.

Above: Radio for the Venezuelan airplane readied by Associated Radio Service Corp.

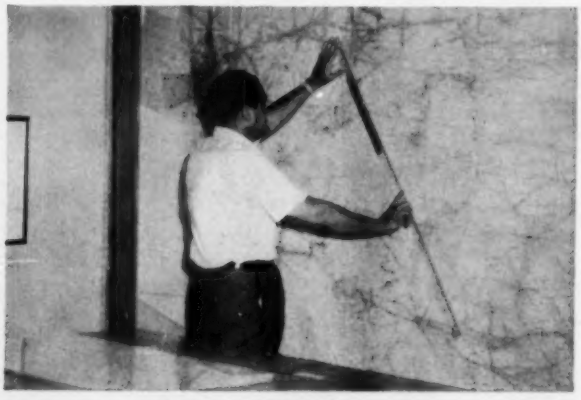
Above: Spare Pratt and Whitney R985 Wasp Jr. engines, before installation by Southwest.



Above: Altimeter, vertical speed indicator are checked at Aero Instrument Service-Sales.



Above: Before departure, Murray receives briefing from Universal Weather Service, specializing in weather information tailored to business pilots.



Above: After completion of the VARCO aircraft's overhaul, Captain Murray begins to plan flight in well-equipped flight operations room.

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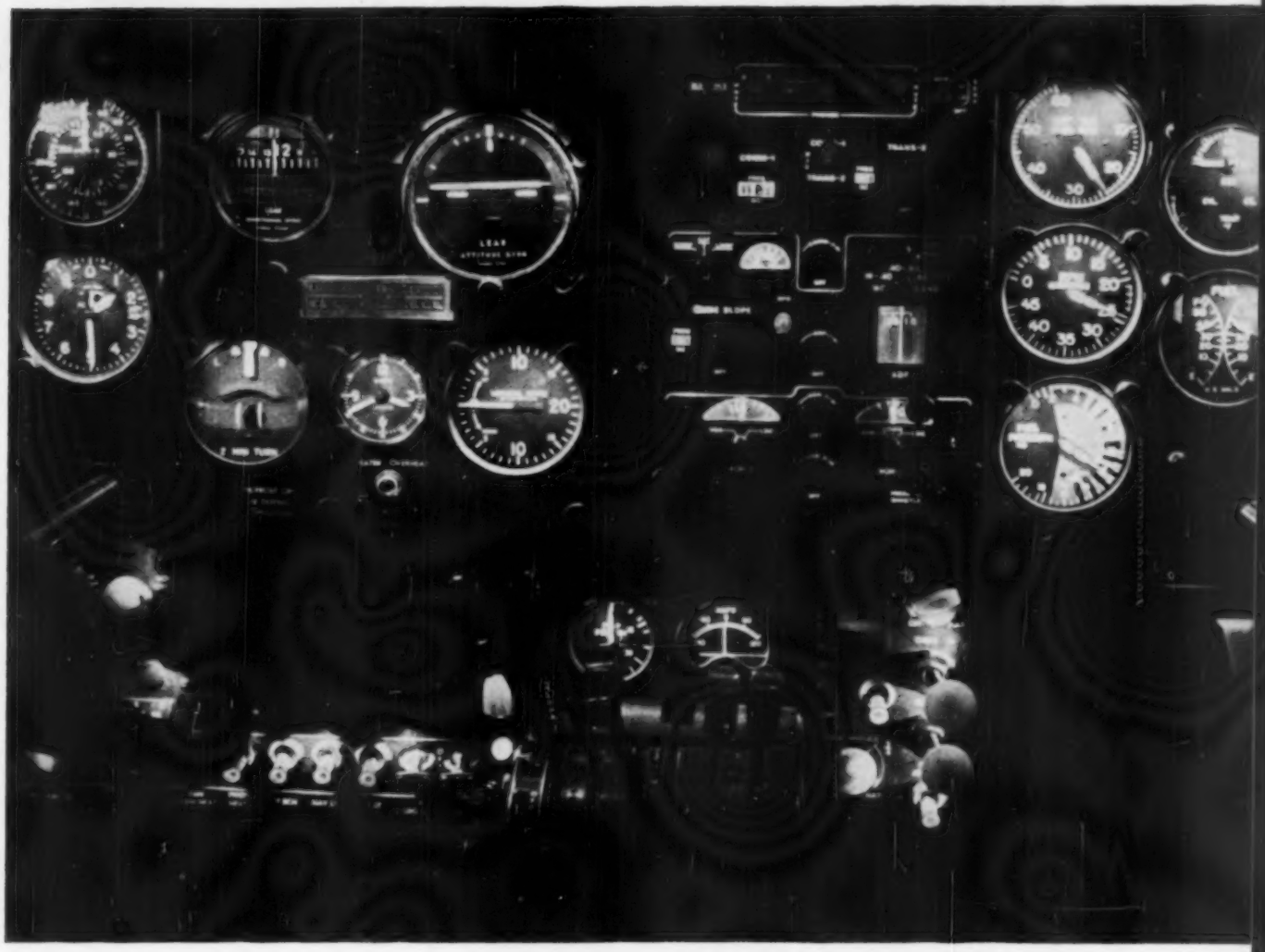

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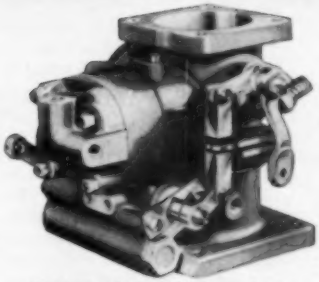

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Trade Shows

(Continued from page 69)

airplane manufacturers and equipment producers lean toward the mass public show. Fairs, consumer goods meetings, educational groups, travel expositions, etc., are getting more responsive treatment. Several companies have taken a crack at county fairs with interesting results.

Amityville Flying Service exhibiting airplanes and promoting flight training at the Long Island Fair sold two planes and signed up 60 persons for flight training. Both purchasers of aircraft would not have searched for the seller; both were from fields of work far removed from easy exposure to the business airplane story at the airport.

Proponents of the broader base, air fair type of event consider that the Wichita Air Fair, held in May can develop into highly effective sales platforms. The Long Island Fair also incorporates the "congress" concept with technical, educational and "Town Hall" type of meetings.

What do organization people think?

IT is difficult for professional staff members of the technical organizations to speak publicly because in most cases pooling programs and effort is a sore subject among volunteer leadership. But, many staff officers see trouble ahead if something isn't done to cut meeting costs and to bolster membership rosters.

A secretary of a national technical society had this to say:

"Obviously, tightening of money and manpower has reduced company and professional membership participation. In addition, the scientist and the engineer today has many more organizations, each with its special obligations and overlapping interests. His or her time for participation is reduced by the heavy hand of job pressure and competition.

"As a result, we're not getting the backing and energetic participation we did during the past five to eight years. At the same time, income is not growing to support rising meeting costs.

"There have been attempts to gain membership approval of joint meeting schedules, but nothing beyond executive committee exploration has resulted. It appears that we'll have to swallow our pride before the topic will receive a fair trial."

In all fairness, a few technical societies still develop programs and incentives which have industry pounding at the door for admittance to the exhibition hall. However, these meetings have been built around strong military leader participation. Belt tightening at the Pentagon is expected to have its influence upon future turnouts.

Technical society exhibits often develop into exhibitor "coffee klatsches" after the opening day when professional people take a quick, curious look for something new, don't see it, and then disappear for good. In most cases the same exhibitors and sales staff are there to show old products to men who—with security clearance or the power to buy—have been frequent visitors to the laboratory or factory.

Recruitment of engineers and specialists—the "missile era slave market" as it is sometimes called—provided the incentive for generous company participation in technical meetings and trade shows during the past decade. Exhibit booths and hotel hospitality suites were glorified auction blocks in reverse—with engineers doing the shopping. Now that the pressure has slackened where volume is concerned, industry and military naturally find it difficult to maintain the same amount of support.

Professional staffs of many technical organizations would welcome full exploration of the problem, even though they'd deny having said it if quoted. They believe organizations should "put aside society pride and form joint committees to explore and develop areas of mutual cooperation—not in name, as now, but in fact!"

In summary, it is important to remember that industry has changed much in character, habit and environment since World War II.

An industry executive explained it this way:

"In the last 15 years, industry has dispersed to inland locations. For example: take the nuclear scientist or engineer in Idaho Falls, Idaho. To discharge his on-the-job travel to various labs and cooperating industries scattered at all corners of the nation, and his obligations to the desk and home leave him precious little time for professional meetings or organizations which have claim upon his special interests. At the same time, as a result of competition, management has no alternative but to ration his time. If he attended all meetings he or the company deems important, management would lose him for about four weeks out of the year, including travel, en route delays, etc. If, however, such meetings were combined into an annual science fair or congress, he'd be gone but a week. It seems to me the latter can be justified."

Here are some advantages expected to accrue from consolidation of meetings:

1) As mentioned, savings of valuable executive time through one-package, annual or semi-annual meeting schedules.

2) Increase quantity and qualitative participation from industry and professional membership.

3) Larger attendance will justify participation of high-ranking leaders.

4) Industry and organization membership will welcome a wider variety of topics and exposure offered by joint meetings and more opportunities to explore broader areas of interest.

TO the exhibitor these advantages could result if a practical joint meeting pattern can be developed:

1) Sizable reduction in transportation or freight charges through reduction in number of meetings.

2) A broader base audience and high qualitative level spreads cost and provides more mileage for the promotion dollar.

3) Better use of sales promotion and technical manpower required to man an exhibit, concentrates talent where greatest exposure and impact upon the broader market can result.

4) Broader market of varied interests justifies better displays—exhibitor can afford more time and money to tell the company or product story.

The big case for combined effort is that such an event cannot help but attract

(Continued on page 108)

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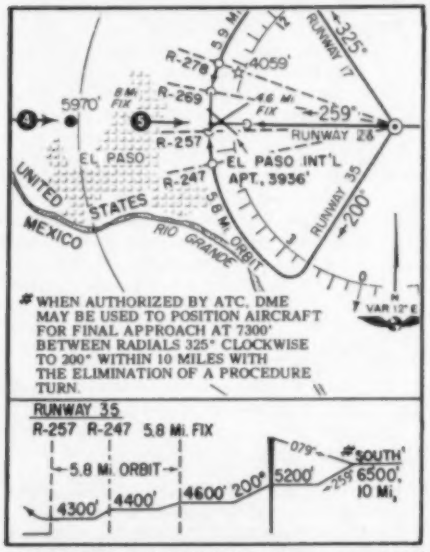

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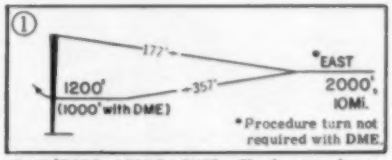

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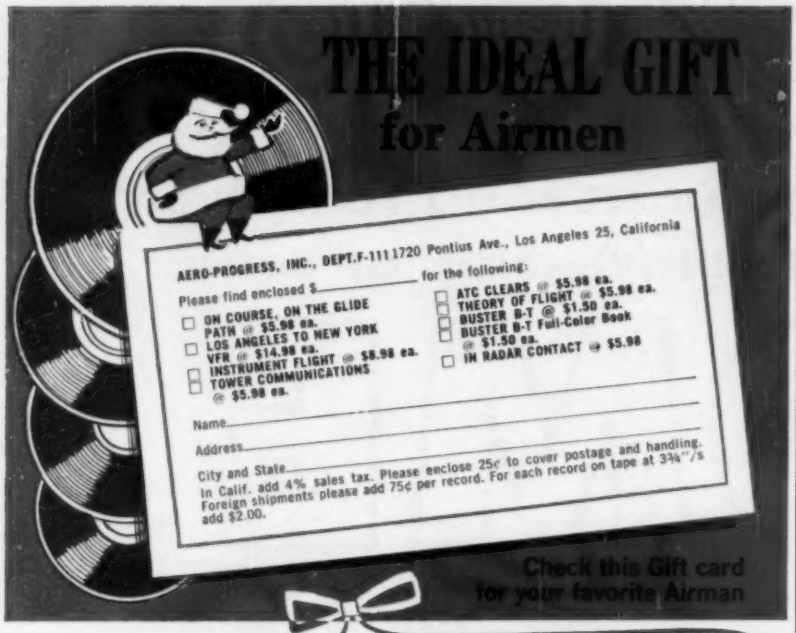
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(Continued from page 106)

groups outside the "family circle" and thus stimulate development of sales potential—either products or services—in other fields.

FLYING feels that the opinions expressed by industry are worthy of more than passing attention. It has also found from investigation that professional staff members of many organizations believe objective evaluation of the annual or semi-annual, multi-organizational congress or science fair is important to future programing.

Industry's concern about "talking to ourselves too much" and holding "too many meetings for the same people" cannot be ignored at this time when its support is vital to the very health of the organizations.

Realistic appraisal and evaluation cannot help but point the way to many mutual benefits and areas of cooperation for industry, professional and trade associations, as well as government-military services.

In the effort, the industrial exhibitor must not be overlooked. His support is vital. Placed in the right climate, he helps turn the soil in new markets, finds new outlets for products, technical and scientific skills. If this is done, we will not be talking to ourselves. END

Wings and Things

(Continued from page 3)

Community effort to make the fields available when they are needed. But airports are essentially a local concern, and they ultimately depend on local understanding of the vital role aviation can play in the economy of any community.

The FAA is also concerned with providing for the safety of this growing aircraft fleet. Our major effort is bent toward improving the air traffic management system to assure safe, efficient, convenient air operations.

A key factor in improving the safety record over the coming decade is the individual pilot's skill in coping with increasingly complex and demanding flying conditions. The FAA will make every effort to bring better pilot understanding of the crucial need to improve these skills, and we plan to develop better methods of insuring that all pilots flying in the United States have adequate ability for the flight situations they can be expected to encounter.

Just as we are going out to general aviation pilots to educate them on the increasing need for improving their flying skill, so also are we making a substantial effort to get their advice on ways to make FAA services more responsive to their needs and to make flying simpler and safer for everybody.

Our Fly-Ins are one method of tapping pilot opinion. Air-Share meetings are another, and they are more specifically aimed at gathering comment on ways of improving the code with which we regulate air safety. We plan a complete overhaul of the rules governing general aviation, and we want to make them as simple and practical as possible.

FAA efforts joined with those of the whole general aviation community should foster a climate that will insure continued growth through 1962 and over the coming decade.

NAJEEB E. HALABY
FAA Administrator

Since May 1961, pilot-editors of AVIATION WEEK, FLYING, B/CA, FLIGHT, AOPA PILOT, AIR FACTS and other major aviation publications have flight-tested the revolutionary Brittain Autopilot. These highly regarded critics then wrote objective reports on their findings which have been featured on the editorial pages of each magazine. *Before you invest in any autopilot* for your present or new aircraft, study these unbiased reports for yourself. Reprints are available without charge (mail coupon below).

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- ☐ AOPA PILOT
- ☐ FLYING (Sept., 1961)
- ☐ FLIGHT (June, 1961)
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Airport Program

(Continued from page 61)

must be approved by the regional FAA office in Kansas City or in Washington.

This is the breakdown for the average federal aid project in Michigan:

56 weeks for the preparation of plans and gathering of project data.

12 weeks the project sits in the hands of the FAA for approval.

7 weeks for advertising bids and waiting for grant offers.

22 weeks for construction.

37 weeks in the closing of the contract and the preparation of final costs.

16 weeks for auditing.

20 weeks for final payment.

A close survey of private construction concerns show they could complete a similar project in 57 weeks.

Add to this a reasonable amount of red tape for government and you can say two years should be long enough.

This is by no means an impossible goal. It is done repeatedly in another branch of Michigan government—the highway department.

On paper the present system of allocating funds looks equitable and easy to operate. It calls for 75 per cent of all federal money to be allocated to states on the basis of population and area. The remaining 25 per cent is set aside in a "discretionary" fund to end whatever inequities might arise.

Some states under the 75 per cent category could seldom supply the necessary matching funds to meet the federal grant. These states, for the most part, are located in the West. They have very little population but a great deal of area. At the same time some states in the East are short changed because of the area-population grants. The money must sit in the allocated state until it goes into a recaptured fund to be redistributed.

Finally the wheels grind and the money is again made available often as long as two years after the original appropriation.

Good hardheaded planning and the establishment of sound allocation procedures would end this seemingly endless maze of red tape.

Leave the 75-25 split the same, if you like. But divide it so that 75 per cent would go to the carrier fields and 25 per cent to the general aviation ports.

Allocate all of the money to specific projects on the basis of need according to a national airport plan. By no means is this split as unfair as it first appears, providing one more stipulation is added.

Allow up to 50 per cent of either fund transfer rights into the other portion so it could be allocated where local and state money was not available.

This plan would accomplish two things presently lacking in the airport program.

1—It would give the air carrier fields money on the basis of need and not simply on the basis of where they are.

2—It would give the general aviation airports something to plan on definitely for the first time in the history of the federal airport program.

Under this system the general aviation fields would not have to stand, hat in hand, waiting for some money to spill out of the coffers. END

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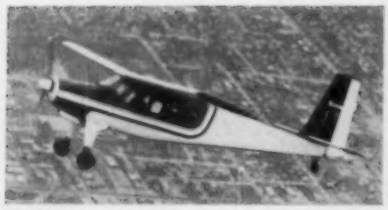


Helio Courier

Shinn 2150-A

Fairchild F-27F

Found F2A-2B

Piper Cherokee

Cessna 320 Skyknight

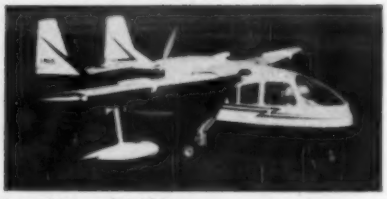
Aerocar

Cavalier 2000

Howard 500

Navion Rangemaster

Champion Tri-Traveler



Lane Riviera FN-333

Fixed-Wing Aircraft

(Continued from page 26)

his first airplane in 1912. Company officials see the best marketing year in the industry's history, plus a big unit increase in its own sales.

Cessna has invested more than twice any previous year's expenditure for the development of its anniversary fleet. First models, to be introduced this month at dealer showings around the nation, include the new 150, 172, Skyhawk, and Skylark. Others will follow at dates yet to be announced.

Changes include expanded performance (see tables), comfort and visibility. The new 210 will feature an all-around windshield, affording 360-degree visibility for occupants. The new Skymaster will be introduced next summer; this airplane, a light-light twin, mounts its Continental powerplants in push-pull arrangement (eliminating torque) on each end of the fuselage; embraces twin tail booms joined by a common stabilizer. Objective: twin-engine performance with operating simplicity of a single-engine airplane.

Other twins will be the 310G and the new turbo-charged Skyknight (see FLYING pilot report, October). Additional single-engine aircraft include the 210, Skylane and 182, Skylark, 172, and Skyhawk 180, Skywagon, plus the 150; also, in the rotary-wing area, its Skyhook, the first helicopter to receive IFR certification. Company has dropped production of the 175.

Del Roskam, Cessna vice president, points to increased development of multi-engine aircraft. Indications are that Cessna will market a new six-to-ten place medium-twin in 1963. Company reportedly has expressed keen interest in the light turboprop, that of Canadian Pratt & Whitney, the PT-6 500-shp engine, and the newly developed General Electric turboprop (see Powerplants, this issue).

Beech Aircraft this year will stagger the introduction of its new models. Last month the Wichita company unveiled its new B33 Debonair and Model 65 Queen Air. New Debonair features increased fuel capacity (from 70 to 78 usable gallons), boosting of cruise range to 1,135 miles. This month the new P35 Bonanza and A55 Baron will make their debut. No changes are contemplated for the Travel Air, Twin Bonanza or Super G18 until next year.

Most interest centers on the new Beech economy model, which will make its first flight late this month, or next. Four-place, all-metal airplane will embrace low wing and fixed tricycle gear. Usable cabin volume will be equal to or greater than competitive makes. Windshield will be single-piece, wrap-around. Swept vertical tail will be patterned after the Baron (which has established new Beech "family look"). Airplane will also feature "all-flying" horizontal tail (stabilator-type). Gross weight will run about 2,300 pounds. Beech will evaluate both Continental and Lycoming four-cylinder engines in the 160-hp range, which should produce high cruise speed to 145 mph. Cost will run $11,000-12,000, with deliveries planned by the fall of 1962.

Beech continues research and development on its pressurized, turboprop executive transport, which will carry six-eight passengers plus crew of two. Aim is

(Continued on page 114)

TOTAL RATED PILOTS

Following are FAA figures for certificated aircraft pilots as of December 31, 1960:

Airline Transport	18,279
Commercial	89,904
Private	138,869
Student	99,182
Helicopter Only	616
Glider Only	802
Lighter-Than-Air Only	410
TOTAL	348,062

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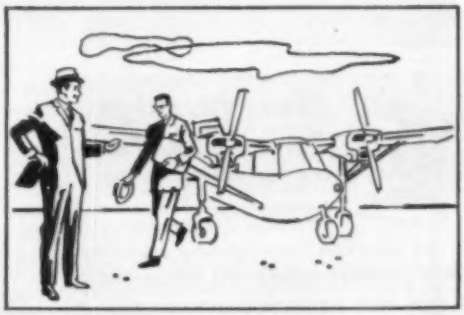

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(Continued from page 112)

speeds from 300-400 mph and cruising range of 1,200 to 1,500 miles. New "King Air" could be powered by Pratt & Whitney or General Electric or Continental-marketed Astazou turboprops, sell in the $500,000 bracket. Company has no immediate plans to market the Turbomeca-Astazou powered Baron (the "Marquis") in the U.S.

Frank Hedrick, Beech executive vice president, sees 1962 sales running 10 to 20 per cent above those for 1961. Biggest movers for Beech this year have been the Bonanza (181 sold the first seven months) and the new Baron (of which 139 were marketed for the same period).

Aero Commander, which produces its light-twin line in Bethany, Okla., had a dollar volume increase of 20 per cent for the first seven months this year; vice president and general manager Thomas J. Harris sees a "proportionate increase during 1962." Company's export business also is running 20 per cent above that of 1960.

Last year, Miss Jerrie Cobb set a new world altitude record of 36,932 feet in the company's 680F. This coming year will see the first flight of another potential record-breaker—the company's new six-eight place, twin-turbine corporate Jet Commander Model 1121 (see FLYING for May, June). The light 14,000-pound executive aircraft will cruise at Mach .8 up to 35,000 feet. Range, with reserves, is specified as 1,500 miles.

Certification of this airplane is expected in the spring of 1963. The fifth addition to Aero Commander's line of executive aircraft will carry two General Electric CJ-610 turbines of 2,850 pounds thrust each. It will use any strip used by the 680F. Company's quoted price does not have any provision for escalation and is a firm commitment to deliver the airplane for $475,000. Optional navcom packages will be available. Firm commitment on delivery is featured; with specified dates beginning in the third quarter of 1963.

Movement of the "third level" air carrier service is being watched closely by Aero Commander. Pending application of Hi Plains Airways for a route certificate contemplating the use of a fleet of Commanders would constitute a new, economical form of air transport that would virtually eliminate or greatly reduce subsidy requirements. It would, via advantages of light-twin economy and flexibility of operation, bring advantages of air travel to a great part of America—as stated by Tom Harris to FLYING, "light twin aircraft would provide . . . an essential step in restoring the full pattern of aviation services to the small communities as well as the major trunk terminals."

Shinn Engineering Co. (Santa Ana, Calif.) has incorporated production and design refinements in its two-place all-metal low-wing 2150-A, a tricycle-gear configuration evolved from the "Nifty" and 2150 design of William Morrisey. Tidy aircraft grosses 1,817 pounds for normal category; 1,570 pounds for utility. It is certificated for both.

Next year a trainer version of the 2150-A will be available; it will not have flaps and will be fitted with a 100-hp Continental engine (as against present Lycoming of 150 hp). Otherwise aircraft will be identical, and priced $1,000 less than current model. Company also has in design stage a four-place airplane intended to sell for less than $12,000, plus a new light twin, also in drawing-board status.

The B.D. Maule Co. of Jackson, Mich., expects to deliver its first Bee Dee M-4 late this month. Programmed to sell for $8,500, the M-4 is a four-place, high-wing aircraft powered by a 145-hp Continental O-300 engine, cruises at 150 mph over a 750-mile range.

Mooney Aircraft, Inc. (Kerrville, Tex.) expects to market some 300 of its new single-engine four-place Mark 21s during 1962. New aircraft went into production in September. In the first seven months of this year Mooney had sold 145 aircraft, a good jump over the 97 sold during the comparative period a year ago. Last year Mooney increased foreign sales 100 per cent; by the end of this year, according to sales vice president Richard S. Martin, the company sees "an additional 100 per cent increase in this foreign market . . . a total of about 10 per cent of all Mooney production will be placed abroad." Expectations call for over $1 million foreign sales in 1962, of which 25 per cent will be placed on the European continent.

Super-V

Maule Bee Dee M-4

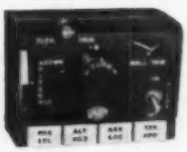
Bellanca 260A

Lockheed Jet Star

New Mark 21 for 1962, with its 180-hp Lycoming O-360-A, continues with its all-metal construction standards. Major changes involve a new hydraulic flap system, with infinite positioning, providing a faster rate of descent and flare-out in landing. Also, there will be a new exhaust

(Continued on page 116)

Command Performance



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SPERRY PHOENIX COMPANY, *DIVISION OF SPERRY RAND CORPORATION, PHOENIX, ARIZONA*

(Continued from page 114)

system which lowers noise level—to boot, cabin has been further insulated to keep out engine and air sounds. Company feels biggest single innovation in its 1962 model is the "around the pilot" instrument console, conforming to standards noted by FAA administrator Najeeb Halaby. Redesigned and contoured seats also provide additional leg room.

Mark 21 instrumentation includes addition of T-formation instruments. All aircraft will be equipped with Garwin Inc. (Wichita, Kans.) pictorial artificial horizon; all instruments are Garwin. Total flap deflection will be 33 degrees; flap area is 17.2 square feet. Cost of the new model: a slight increase over this year's $15,995.

Currently flying as heavier business aircraft are the pure-jet Lockheed JetStar and the turboprop powered Grumman Gulfstream and Fairchild F-27.

The JetStar, the first American produced pure jet, was certificated in August after flights running from low speed of 110 mph to dive speed of 700 mph. The 10-passenger executive jet is powered by four Pratt & Whitney JT-12s of 3,000 pounds thrust each. It has flown up to 45,000 feet at speeds in excess of 630 mph. Continental Can was among the first of 25 customers scheduled to take delivery of the $1,300,000 aircraft this year (eight aircraft) and through 1962. Military orders (11) also are being filled.

Purchasers of the air-conditioned, pressurized jet, produced at Lockheed's Marietta, Ga., division, include firms covering six nations. Range is over 2,600 nautical miles; gross weight is now 40,100 pounds, and expected to increase with jump in engine ratings.

Another Lockheed airplane, the LASA 60 marketed by Lockheed International, is being produced in San Luis Potosi, Mexico; Cordoba, Argentina, and Milan, Italy. The single-engine, rugged four-place "back country" bush plane is designed for high-altitude work and heavy duty operations on rough fields. It is being sold in Alaska (equipped, in the neighborhood of $22,000) under an exclusive arrangement with Alaska Airlines.

Grumman Aircraft Engineering Corp. (Bethpage, N.Y.) had delivered 70 of its Rolls-Royce Dart powered Gulfstreams as of August 31; its Gulfstream program began in May, 1959. Selling at a basic price of $896,000, the 10-12 place, 35,100-pound Gulfstreams have flown 68 million passenger miles and 35,000 hours.

Production of the 350-mph turboprop executive transport continues at the rate of three per month. Improved fuel capacity to 12,100 pounds of fuel gives the airplane a range of 2,940 miles, a 400-mile increase. Gulfstream is a strong contender for U.S. Navy utility type service; possibility exists that it may convert to General Electric T64-GE-4 and -8 turboprops delivering 2,850 shp each. With wing sweep it also could carry pairs of aft turbofans, as a pure jet with 500-mph plus speeds.

Fairchild Stratos Corp. (Hagerstown, Md.), after nearly a year's lull in production and sales, has reactivitated the F-27F Rolls-Royce Dart powered turboprop; first of eight new units to be built at one-a-month rate rolled off the line in September. The new models will have higher gross weight limits (36,700 to 39,400 pounds); better altitude limits with FAA approved operations at 25,000 feet; 1,920 gallons of fuel (as against prior 1,700 gallons) for transcontinental operations. Company plans to raise weight limit certification of the G model to 42,000 pounds as part of 1962 product improvement program.

Fairchild has 87 F-27s in service: 29 in corporate use and 56 in airline service. Business flight hours of the 10-18 place airplane are 29,718, and airline operational hours (at this writing) were 236,420. Basic price is $830,000, with increase expected next year. Fairchild also is thinking of conversion to U.S. powerplants, should such improve military-government sales opportunities.

Cessna 180

Schweizer 1-26

On Mark Marksman

Champion Lancer

North American Sabreliner

Beech 65 Queen Air

Piper PA-23 Aztec

Beech B33 Debonair

North American's T-39 Sabreliner, for which FAA certification was expected by last month, is flying as a twin-jet utility transport with the Air Force, which has ordered 94 of the six-eight place aircraft. The U.S. Navy has ordered 10 Sabreliners. Powered by two Pratt & Whitney JT-12 turbojets of 3,000 pounds thrust each, it cruises at 500 mph. Range runs to 1,725 statute miles (see pilot report in July FLYING).

Company was yet—at this writing—to commit itself to putting the Sabreliner on sale commercially. Tooling of the executive jet—at the company's Los Angeles division—would allow a 20-a-month production rate (Air Force is taking five per month). Cost of commercial version would approximate $750,000, minus electronics.

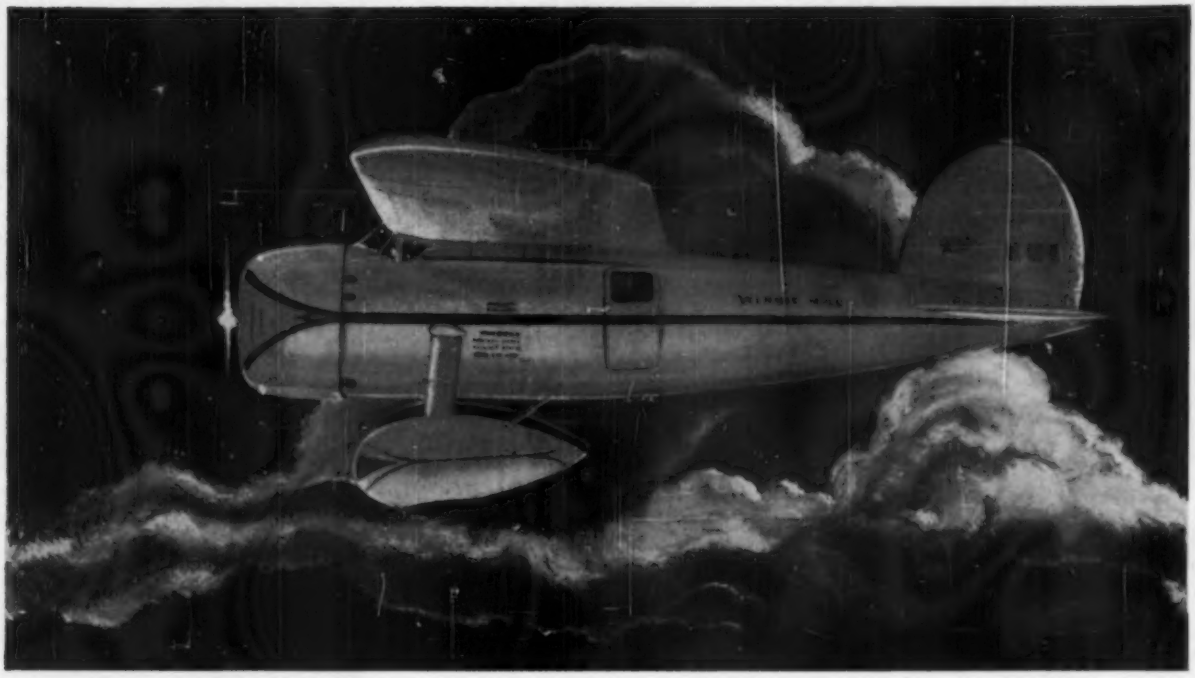
Other improvements are in the works at light-aircraft manufacturers.

Champion Aircraft, Inc., of Osceola, Wisc., rolled out its first light twin Lancer in September (see FLYING for that month). Light aircraft, undergoing certification testing, is a low-cost airplane ($10,00-11,000 category) with fixed gear and high-wing configuration. A two-place personal/business aircraft, it will be ideally suited to low-cost student upgrading to a multiengine rating. Powerplants are in the 100-hp category. Aircraft will be available in 1962.

AirCoupe Div. of Air Products Co. (Carlsbad, N. M.) is modifying its two-place airplane to the extent of retractable gear, square-corner wing tips, additional four square feet of wing area, skin stress rather than internal stress of earlier models, continuation of conventional controls. Continental O-200A of 100 hp gives additional 10 hp over earlier models. Gear and wing stressed for 200-pound increase to maximum gross weight of 1,650 pounds. Airplane may go three-place. Cost will jump from $7,450 to about $8,250.

Lake Aircraft's LA-4, only single-engine amphibian produced from scratch in the U.S. (Sanford, Me.), hopes to exceed 110 deliveries in 1962. President John F.

(Continued on page 118)



Lockheed Vega—1927

The early pages of aviation history are sparsely dotted with the names of courageous flyers who made successful flights around the world. Wiley Post made the amazing flight two times in his famous plane, the Winnie Mae. The Winnie Mae was built by Lockheed in 1927 and was powered with a 550 h.p. Whitney Wasp engine. Equipped with a supercharger, it permitted an increase in cruising speed from 140 m.p.h. to 150 m.p.h.

Post's first global flight was in 1931. The Winnie Mae took him from New York to Newfoundland. Spanning the Atlantic to England, he then raced to Berlin, Moscow and Alaska. Returning to New York, his total time was 8 days, 15 hours and 8 minutes. His second global flight, in 1933, was a test run for the Sperry Gyroscope automatic pilot and radio direction equipment which registered the direction of the station being heard. This flight was completed in 7 days, 18 hours, 49 minutes. With two global flights to its credit, the Winnie Mae earned an honored rest in the Smithsonian Institution as one of aviation's history-making planes.

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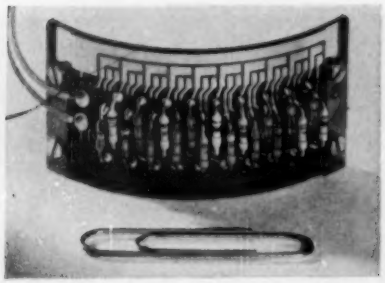

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(Continued from page 116)

Strayer sees a definite upswing in industry sales; points to added foreign potential tied to additional distributors abroad. New distributors have been added in Alaska and Thailand.

Lake plans to redesign the instrument panel in 1962 models, enlarge the central radio panel, provide 2.5 more inches of leg room and expand cabin length 14 inches. Four-place, agile amphibian also is suited for the Lycoming fuel-injected development of the 180-hp O-360 engine, which would produce 205 hp at 2,700 rpm. Large nose wheel also will be added (for soft beaches), which will be interchangeable with main gear.

Lane Aircraft (Dallas, Tex.) will begin production of its single-engine Riviera amphibian next month. First of the SIAI Marchetti (Milan, Italy) designed aircraft, powered by Continental IO-470 fuel-injected engine of 260 hp, arrived in the U.S. in September. Aircraft will be shipped to Dallas minus engine, propellers and instruments. Southwest Airmotive will assemble.

Riviera is four-place, all-metal with cruising speed approximating 165 mph; top speed, 182 mph. Standard equipment will include dual controls, full instrumentation. Cost: $34,950.

Helio Aircraft Corp. (Norwood, Mass.), which produces the five-place single-engine Courier and Super Courier STOL aircraft, this month is scheduled to deliver the first of its light-twin prototypes to the Air Force. Initial order of five-six aircraft is expected from the military.

Powered by two 205-hp Continental engines, the light-twin STOL is a six-place airplane. FAA certification is expected about the first of the year, following which aircraft will be made available to the civil market. Price is not yet set.

Downer Aircraft (Alexandria, Minn.) and Hammond Aircraft (Oakland, Calif.) at this writing are discussing a merger which would find the Bellanca 260 and Super-V produced under one roof. Four-place Super-V, executive-twin conversion of the Bonanza, is powered by two Lycoming 180-hp O-360 engines producing 200-mph plus speeds. The new four-place Bellanca 260A incorporates many refinements including increased cabin space, window area, eye-appeal paint, etc., tied to its 203-mph cruise. Production of 10-a-month is anticipated.

Navion Aircraft Co., Dallas, Tex., anticipates production of 300 of its Rangemasters in 1962 (see pilot report in May FLYING). Completely redesigned airplane is five-place, powered by 260-hp fuel-injected Continental IO-470H. Basic price is $22,500. Under consideration is a six-place light-twin, swept tail, which would accommodate two 260-hp Continentals or available turbine powerplants. Plus a six-place Super Rangemaster, powered by a 340-hp supercharged Lycoming, which would be marketed for about $32,000.

Meyers 200B, produced at the company's Tecumseh, Mich., facilities, combines smart lines of design coupled to 200-mph speed. Four-place airplane has excellent rearward visibility. Selling price is $24,640; company expects to produce four units per month in 1962.

Aerocar, the "flying automobile" designed in Longview, Washington, will be produced by Ling-Temco in Texas. This aircraft, powered by its 143 HP (derated) Lycoming O-320, will be featured in a new TV series starring Bob Cummings.

The Phoenix Aircraft Mfg. Co., of Nanuet, N.Y., is producing two models of the Brigadier B-290. Now undergoing flight test for a type certificate, the twin-pusher airplane will be powered by 145- or 260-hp Continental engines. A five-place, 4,000-pound aircraft, the Brigadier will cruise (with the smaller engines) at 155 mph over an 850-mile range, require 1,300 feet to clear a 50-foot obstacle on takeoff. Anticipated price is $37,000.

Aircoupe

Lake LA-4

Brigadier B-290

Volair Model 10

Volaircraft, Inc., at Aliquippa-Hopewell Airport, Pa., will be marketing a new high-wing, all metal lightplane for about $7,500. New aircraft is powered by a 135-hp Lycoming O-290-D2C. Tricycle-geared airplane features rear window for 360-degree visibility; forward-sweep vertical fin. Certification will be for three-place, with four-place to come. Company is gearing for one-a-day production.

On-Mark Engineering (Van Nuys, Calif.) reports 48 of its B-26 conversions sold during 1960. The Marketeer, and the pressurized Marksman (six sold to date, this year), continue to fill a specialized

(Continued on page 120)

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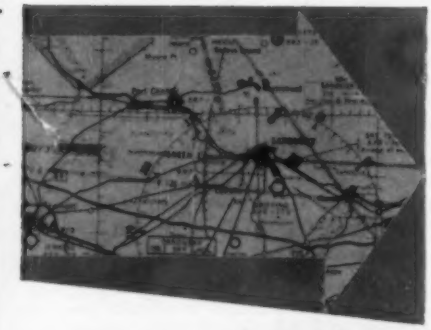

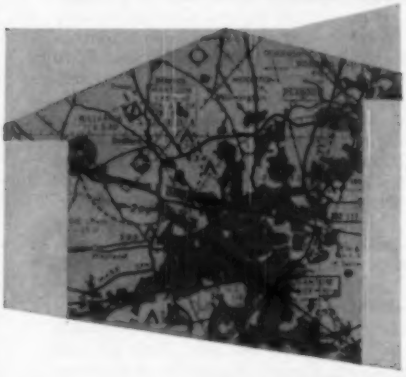

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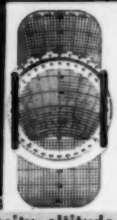

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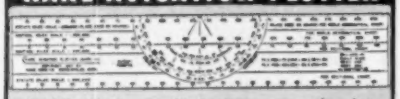

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(Continued from page 118)

mission in the business aircraft field. Conversions of the fast USAF B-26 run from $257,430 to $361,492.

Another conversion for business use is Trans-Florida's Cavalier 2000, a completely remanufactured F-51 Mustang. Combining 96-gallon tip tanks with a 40,000 foot service ceiling and a red-line airspeed of 490 mph, the easy-to-fly Cavalier 2000, turned out at Sarasota, Fla., can fly 2,000 miles-plus, non-stop. Basic price: $32,000.

Volpar tri-gear Beech conversion of the standard D-18S or C-45 has received the FAA Supplemental Type Certificate. Modifications, as done by PACaero Engineering Corp. (Santa Monica, Calif.) and its parent Pacific Airmotive Corp. (Burbank, Calif.) have sparked increased performance, plus boost in maximum takeoff gross weight to 9,800 pounds. Price of weight modification and gear conversion package: $35,595.

Riley Aircraft (Ft. Lauderdale, Fla.) offers its Cessna 310 conversion with Lycoming IO-540 powerplants. Engines are derated from 295 to 260 hp; most of the performance gains are realized at high altitude. Reported cruise of the "Rocket" at 14,000 feet is 263 mph; at 10,000 feet, 250 mph. Cost, with auxiliary tanks (20 gal. each): $54,950.

Howard Aero, Inc. (San Antonio, Tex.) is moving closer to final 4B certification—expected by the end of this year—for its pressurized Howard 500; a new production airplane derived from the Super Ventura. Provisional 4B type certificate was awarded in January of this year; at this writing the fast airplane had completed all upper-air recordings. The 11th Howard 500 was delivered the end of August.

Howard's Lockheed Lodestar 250 conversion program will meet the 4B performance category. Airplane already has flown TAS of 265 mph producing 690 hp. Gross weight increase, to 22,500 pounds, also is under way.

Latest Howard program, now under way, will be called Howard 350, which is a 300-mph, 14-passenger, tastefully-styled aircraft with many new features. The Howard 350 is aimed at the price bracket between the Howard 250 and the 500.

Realism in design, production certainly will dominate the 1962 scene. Joint pursuits also will be directed at better air space utilization for the general aviation pilot; more airports; improved navigational systems; simplified equipment and aircraft operating requirements; and—last, but not least—more airplane for the dollar. END

The Older Pilot

(Continued from page 73)

the pupils tend to become smaller, and because the retina at the back of the eyeball loses some of its sensitivity to light, especially after age 60. The older eye makes its adjustment to the dark as quickly as the younger one, but does not attain the same level of sensitivity. Hence night vision is most sharply affected, so that the pilot age 45 might need 150 per cent more illumination at night than a 25-year-old pilot; a 58-year-old pilot may need 10 times the amount of light that a 21-year-old would require. Landings under minimal light conditions could profitably use the eyes of a younger man.

Yet acuteness of vision varies enormously in any group, young or old; many men 50 years and beyond have keener vision than men in their twenties. Besides this variation, a pilot may develop sharper visual abilities simply because his job requires that he use his eyes in particular ways for his tasks. For example, many pilots develop skill in using the outer portions of their vision, especially in spotting distant aircraft and in landing, as well as other special tricks of seeing.

The sense of hearing declines with age, especially in the higher frequencies above 2,000 cycles per second. The range of voice frequencies (below 2,600 cycles per second) is not normally affected, nor is the standard radio beam frequency (1,020 cycles per second). The highest of the three frequencies for fan and cone markers (3,000 cps.) may be partially affected. The above-average hearing loss for the airline pilot group may be due to prolonged noise exposure, but the difference from the normal amount of loss is very slight. Decreased hearing can be compensated by increasing the sound volume on radio or in conversation. Generally the pilot with some hearing loss can hear about as well as the average normal person when both are forced to tolerate interference with speech and radio signals by masking noises of the same frequencies. Impaired hearing, resulting from age alone, will rarely harm performance.

Manual dexterity involving muscle coordination and reaction time are affected by age, but deterioration in any one area does not necessarily have an adverse effect on over-all performance. Quickness of response increases through childhood and youth, followed by a gradual decrease with maturity. Tests of 200 airline pilots, which involved coordination of stick and rudder movements in response to a changing visual pattern, showed that the younger pilots completed the 40 different settings faster than the older group (ages 40 to 47). Yet many older persons who retain quickness of response continue to compete well with much younger individuals. While quickness of response declines first and most markedly, coordination of hand and eye usually remain excellent, permitting an increase in competent performance in any vehicle, as maturity progresses. Admittedly, it is true that a slower reaction time might be critical in landing procedures when a large number of actions must be carried out rapidly.

Memory, imagination, and learning reach a peak between ages 20 to 25, and very slowly decline thereafter. Yet no one under 45 years should refrain from learning a new task solely because of the belief or fear of being too old to learn it. The more a mental activity depends on experience, judgement, and reasoning, the more it resists the erosions of age. The older individual needs more time to learn new material and needs stronger impressions to stimulate his memory; his greatest difficulty occurs when the learning of new material requires the "unlearning" of old knowledge and habits, such as the switch

(Continued on page 122)

Should You Use Detergent Oil?

Ever since the introduction of aviation detergent oil some twelve years ago, questions have come up regarding its use and benefits. The Gulf Oil Corporation, which produces and sells both detergent and non-detergent aviation oil, hopes that the information below will help you decide whether you should use a detergent oil.

WHY USE A DETERGENT OIL? Certain parts of your engine become very hot during operations and this heat causes deposits to form on such parts as valve stems and pistons. These deposit formations become a major factor in determining the time at which your engine will require overhaul.

In addition, they may cause such specific problems as sticking valves, sticking piston rings or burned pistons. A detergent oil that keeps parts clean as it lubricates will obviously give you longer engine life.

CAN DETERGENT OIL CAUSE PROBLEMS? The first detergent oils proved to be highly effective in certain types of engines, but were unsatisfactory in other types of engines. Gulf, after much research and testing, developed an improved formula for unrestricted use in any piston engine aircraft.

This detergent oil, sold under the brand name of Gulfpride Aviation Series D meets—in fact, *exceeds*—the performance specifications for both Continental and Lycoming engines, and is suitable for *all* types of aircraft piston engines under *all* operating conditions.

ARE ALL DETERGENT OILS ALIKE? No. Different brands are made from different base oils and contain different amounts and types of detergents. Furthermore, some brands are multi-viscosity and others are single-viscosity.

Gulf believes that the detergent used in Gulfpride Aviation Series D is superior in keeping engine high-temperature zones, such as valve stems, rocker boxes and piston ring areas, clean. In other words, Gulf's detergent dispersant works best where it's needed most. Gulf and the engine manufacturers recommend *single*-viscosity oils for aircraft engines.

WHEN SHOULD A DETERGENT OIL BE USED? The best time to start using Gulfpride Aviation Series D is when your engine is new or freshly majored. Twelve years experience, however, has proved that you can benefit by using Gulfpride Aviation Series D regardless of time on your engine. Change oil *faithfully* as recommended by the engine manufacturer. This simple procedure will pay off in better engine performance and *more hours between engine overhauls.*

ANY OTHER QUESTIONS? Gulf has additional information available in a Gulf product review on both Gulfpride Aviation Series D and Gulf Aircraft Engine Oil. Write to Aviation Headquarters, Gulf Oil Corp., P.O. Box 1519, Houston, Texas.

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AVIATION PRODUCTS

(Continued from page 120)

from two-engine to four-engine aircraft or to jets. In spite of this difficulty, the older person is particularly well suited generally for tasks which demand high degrees of accuracy, once any new material has been properly learned and practiced.

Memory for recent events is most seriously impaired with age; though with oxygen deprivation at altitude young men may quickly develop as serious a temporary defect in recent memory as an older man has under normal conditions.

No adverse trends in mental performance need occur in the pilot group up to ages 55 to 60 years, if native mental ability was originally good, and if both motivation and interest in their work remain high. Capacity for understanding, reasoning, and judgement can remain unaffected and relatively constant as long as the individual remains involved with active mental work and intellectual interests.

Over-all proficiency as indicated by accidents in the AAF appeared to improve up to about age 34, slipped downward slightly to about age 40, while after 40 years the accidents due to pilot error alone progressively decreased. Also errors due to lack of proficiency, violations, and misjudgement of distance decrease generally with age; though accidents caused by misuse of controls and marked failure of observation tend to increase with age, probably due to overconfidence in some older pilots.

An airman is as old as his vision, his muscular coordination, and his skill, as well as his mental adaptability to flight conditions and problems. Operating safety in aviation depends on the extent of deterioration of any one physical or mental activity, and age alone in number of years is rarely the sole determining factor. The pilot's individual ability to perform his duties, rather than his age in years, can be the determining factor in his continuing career or hobby in aviation, provided he shows satisfactory responses to proper stress situations (exercise, altitude chamber studies, reactions to emergency situations), and provided he checks out satisfactorily under actual flight conditions or in a flight simulator.

The commonest problem of the older pilot is the discovery that the years have further deteriorated a slight or marginal defect that was present in much younger years, especially increasing difficulty with near vision and hearing difficulties in the voice-radio range of sound frequencies. Other common problems include an early lack of adaptability to new situations which has worsened, increasingly intense emotional reactions to flight experiences, and an increasing inability to adjust to new equipment.

All in all, 60 years is a good cut-off age for the professional, since most mental and physical abilities hold up well into the late fifties. Dark adaptation of the eye decreases rapidly after 60 years.

In view of the progressive problems of age, the older pilot should gracefully acknowledge the ravages of time, check himself out on cockpit procedures often and faithfully, spend extra time in learning new material, put his accumulated experience to use, and further develop his accuracy in flight planning. END

FREE ON REQUEST

OF THE 50 STATES, 42 have an aeronautics commission or its equivalent. They distribute specially printed charts, notices to airmen, newsletters and detailed airport directories.

The Mississippi Aeronautics Commission distributes an aeronautical chart of the state that gives a complete picture of the facilities available for the pilot. It uses the same scale as the World Aeronautical Chart, and you need only the one chart instead of three WACs ordinarily used. On the reverse side of the chart is printed an airport directory showing the layouts of the major airports in the state. A mailing list is kept of all persons interested in receiving notices on airports and radio facilities to keep the chart current.

Other states having a similar aeronautical chart are Alabama, Pennsylvania and Kentucky. Wyoming, Montana, Arizona and Utah also have aeronautical charts but in contour, which makes them very effective for flight planning purposes. Virginia, New York and North Dakota have available charts showing the locations of airports in the state.

The majority of the states offer airport directories on request. Some of these directories are elaborate and complete in detail while others are hardly more than mimeographed descriptions of public use airports within the state.

The Vermont Aeronautics Commission definitely has its eye on the flying vacationist. Not only does it send out a directory, but a deluge of folders on the state will accompany it. Florida does the same.

Among the unusual items available for flight planning is the colored cloud chart sent along with the Directory of Approved Airports of South Dakota. This cloud chart shows cloud formations and accompanying weather predictions for the state.

Although you might not suspect it, Hawaii holds its own with the older states in helping the out-of-state pilot find his way around. Its directory gives a complete guide to flying in the Islands.

Idaho's aeronautical chart is in contour, and the directory not only provides "Do's and Don'ts on Mountain Flying," but also gives explicit information on how to get into and out of many of the high altitude airports and what to do while waiting for the wind switch. Instructions at Fish Lake Landing Field, for instance, are, "Take-offs recommended down canyon—get a shovel and fill in rough spots while waiting for windshifts or proper operational conditions instead of sitting in the shade."

While Alaska's airport directory with revision service costs $5 per copy, a pamphlet published by the FAA entitled "General Information on Flying to and in Alaska" is available free by writing Alaska Department of Public Works, P.O. Box 1361, Juneau.

A few states have charts and directories available free only to registered pilots in the state. One state in particular that has a very good chart and directory for a nominal charge is Nebraska. One side of the chart uses the Sectional scale and the other side has the WAC scale. This sells for $1.25, and the directory with its airport layouts and other pertinent information sells for $1.50.

Some Aeronautics Commissions offer a free revision service, sending the latest aviation changes for the state.

If you're wondering where to send for all this information, all Aeronautics Commissions are located in the state capital.

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Variable Sweep Wing

(Continued from page 72)

been available for more than 18 months. And the Moscow airshow in July on Soviet Air Force Day showed that the Russians are still intensely interested in manned aircraft and are putting the latest aeronautical research information to work in operational airplanes.

Four major advantages are attributed to military aircraft equipped with variable sweep wings. These are:

● *Low gust loading.* When the wings are swept back more than 70 degrees, it is possible to make on-the-deck attacks at supersonic speeds, under defending radar screens. Such attacks are not possible with today's military aircraft because their wing sweep is 45 degrees or less. Therefore, they bounce around badly in turbulent, gusty weather during high-speed flight at sea level.

● *High loiter time.* Greater endurance and increased time in the air are provided when the wings are brought forward to the optimum position for each flight speed. In most military operations good loiter performance and long time on station provides insurance that any mission can be carried out.

● *Long ferry range.* Rapid movement of attack aircraft from the continent is a basic part of U.S. defense plans. Today this movement requires in-flight refueling or landing at vulnerable ground bases. Variable sweep wing will allow transoceanic flights without the necessity of refueling.

● *Short take-off and landing.* The straight wing configuration allows aircraft with variable sweep to land at speeds 25 to 50 per cent lower than high performance airplanes using conventional delta or swept wings. Takeoff performance also can be improved substantially.

One major point is emphasized by all engineers working on the new wing. It bears little resemblance to the variable sweep wing which was tried with limited success on the X-5 and XF10F in the early and middle 1950's. The 1961 version is much lighter and does not have the stability and control problems which plagued the old models.

Two questions regarding the safety of the wings have been answered positively during the past year or so of research. First, the wings will be linked together mechanically so that it will be impossible for one of them to move without the other. Second, wind tunnel tests have shown that the variable sweep wing aircraft being considered today could be landed safely with the wing locked all of the way back into the maximum sweep position. There would be a large increase in landing speed but the aircraft could still be brought in using the normal control system.

Research work is progressing so well that many industry engineers today predict that within 10 years variable sweep wings will be as common as flaps on all new high speed aircraft. END

Navcom Equipment

(Continued from page 39)

The Starflite III system, to medium single-engine airplanes, will include the 501 ADF, VHF, navcom, and ARC's new "less than $1,000" single-axis autopilot. ARC is now expanding all three systems to offer complete coverage in all fields of general aviation navcom.

Bendix Radio Division of the Bendix Corporation, probing the field of general aviation, discovered that its RDR-1 weather radar would fit in the larger executive aircraft, from medium to heavy twins and up. A recent count showed that 552 of the $11,000 RDR-1s have sold to general aviation, and sales came very close to boom proportions for Bendix. The company is turning more toward this relatively new market, and in mid-1962 will offer a light transponder to general aviation as well as to airlines. Early 1963 will usher in a Bendix DME for both markets. Bendix Corp. has its own transistor manufacturing division, and as a result, Bendix navcom is either heavily or completely transistorized. The company feels that solid-state electronics is the next big cycle in navcom. Today, a 560-channel VHF receiver requires a large array of crystals, and Bendix is working to replace them with an arrangement of transistors for more reliable, less expensive operation. The frequency selector on the instrument panel will remain unchanged, but the box behind it will be cool and efficient.

Recognizing the potential for sales in the tremendous field it is discovering, Bendix is this month coming out with a self-monitoring VHF navigation system. Called Vor-Check, this receiver features a test button on its control panel that when pressed, swings the omni needle of a radio magnetic indicator to zero on its dial if the equipment is giving correct bearing information. On installations without an RMI, the vertical course needle will center when the button is pushed if all is well and a heading of 360 is selected. Bendix, entering more boldly into the general aviation field, is watching reaction to its Vor-Check very closely, and very hopefully.

A giant in the field of navcom, the Collins Radio Corporation is this year "more aware that general aviation represents a complete aviation business", and is accelerating its effort and producing a complete new line of smaller aircraft navcom equipment. Now doing 30 to 40 per cent of its business with general aviation, the company that built its name on airline radio plans to aim primarily at airplanes at and above the level of the light twin. At the point of Collins' drive to increase general aviation sales is its 618F-1C VHF transceiver. Available now, this 360-channel, 50-kc spaced unit has a remote power supply and channelizing equipment; its control head can be installed on instrument panels too crowded for similar conventional equipment.

Other projects designed for general aviation aircraft are well into development at Collins, where one in four employees works in research and development. The company, however, is reluctant to speak of its plans, and will spring new equipment on the market as it becomes perfected.

DARE, Inc. has been primarily interested in general aviation since it began as a two-man operation in a backyard garage in

(Continued on page 126)

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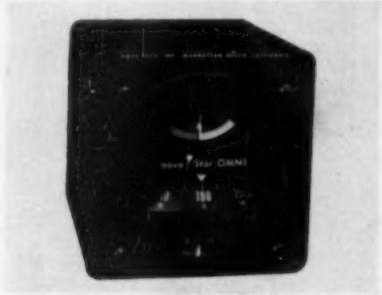
AVIATION SERVICE DIVISION

spartan *AIRCRAFT COMPANY / TEmple 5-4491 / Municipal Airport / Tulsa, Oklahoma*

(Continued from page 124)

1948. Now with 450 employees, DARE's DTR-360B transceiver was recently chosen to equip all 48 of the Philippine Airline aircraft in this company's first substantial sale to a scheduled airline.

With seven European distributors, much of DARE navcom is sold overseas. At first a little surprised at the cooperation of European certifying agencies in helping an American manufacturer, DARE says that its equipment is now the only U.S. navcom licensed Class 1 (approved for unrestricted IFR use) in England, Germany and France. Currently the hottest item on DARE's shelf is the all-transistor DR-480 navcom receiver. A pair of the low-voltage 480's, which can operate from either aircraft power or



Nova-Tech Nova/Star omni indicator.

dry-cell electricity, has been installed in a Beechcraft Bonanza, and is now on a demonstration tour across the country. A recent advertisement brought 870 inquiries from pilots and general aviation operators interested in the little 480, and even now a companion transmitter is under development, planned for a 1962 sale date.

DARE emphasizes that it places service of equipment already in operation high on its priority list, but is nevertheless developing its own DME, HF communication, and transponder equipment for general aviation.

The King Radio Corporation, which turned its efforts to aircraft radio in mid-1959, has become one of the fastest-rising navcom producers in the general aviation industry. King today has 11 aircraft radio units for sale, through 176 dealers in the U.S. and Canada. With a history that had sales doubling every three months of 1960, the company is "pleased" with its growth today, and is pressing development of its KR-80F ADF unit as well as new lightweight DME. The young company has become the first navcom producer to offer a one-year warranty on all parts, including tubes and transistors, plus a 90-day warranty on labor.

The KX-100 communication and VOR/Localizer unit has been the single best-selling item in the King stable. The KN-50 navigation receiver, however, is offering it some competition, and in mid-August was sold out more than a month in advance. Latest to be offered to general aviation are King's 360-channel, 50-kc KY-95, KX-120, and KX-130, whose prices appear for the first time on these pages.

The National Aeronautical Corporation has been equipping general aviation as it came of age, and rode the crest a real boom in navcom from 1955 to 1959. With a $5.4 million gross sales in 1960, NARCO expects a 15 to 20 per cent increase this year and a similar increase in 1962. For Narco, however, this is normal growth in a growing field, and not at all a boom. The company feels that the greatest potential for sales today lies in the working airplane, the airplane that flies 300 hours per year and more, whether the operator is a private individual or a giant corporation. After a brief attempt to produce an airline transmitter and receiver (the 1016 and 1021 Sapphire), Narco decided to remain entirely with general aviation, and this year has introduced the Mark 7 and Mark 10 communication and navcom transceivers, and the UDI-2 DME.

Elated with the response to the DME, Narco is producing approximately 150 of the $2,250 units each month, and back orders from dealers increase each month. In September a Narco dealer had to order his DME equipment 60 days ahead of the time in order to give his customers off-the-shelf delivery. The company is calling the 1960's the "decade of DME", and predicts that distance measuring equipment will be as important a factor in this decade as VOR was in the 50's.

The Wilcox Electric Company slants its sales primarily to airline and instrument flying general aviation customers, and has recently introduced its 800-series lightweight aircraft electronics. Wilcox has found a "tremendous interest" from general aviation for its 814 transponder, and estimates a market for approximately 1,000 of the units now exists. For Wilcox as for the other manufacturers, solid-state electronics are more reliable with less input voltage (28 volts vs. 200 volts on some earlier equipment), and produce less heat. But the company feels that it is possible to go overboard, installing transistors for transistors' sake. Any given radio will involve more components if built with transistors in place of vacuum tubes, and with increased components come more opportunities for failure along the line. As with most other companies in the field, Wilcox installs a transistor only after it determines that it will be more of an improvement than a chance for breakdown. Wilcox has joined with Hoffman Industries in the production of lightweight DME. Hoffman has built some 18,000 TACAN sets for military aircraft, and the experience will make the Wilcox-Hoffman DME a major contender in the field.

The Radio Corporation of America last month announced that its transistorized AVQ-55 weather radar, designed especially for general aviation aircraft, will sell for "1,000 or less". The new general aviation radar, which appeared for the first time at the September meeting of the National Business Aircraft Association, will be available in January, 1962. RCA has already expanded its Los Angeles engineering staff, and under policy that calls for broadening of its product line to cover lower-cost general aviation aircraft, has begun development of further navcom equipment.

Nova-Tech, Inc. is in business primarily to serve the pilot who flies for business or pleasure in light two- and four-place airplanes. Nova-Tech points out that this pilot needs reliable, professional navcom just as much as does the operator of a light or heavy twin.

In 1960, the company did some $336,000 in gross sales; 1961 saw a gross sales of $464,000, a suitable exclamation point to Nova-Tech's comment that response to its low-cost equipment has been "excellent". The Nova-Star Omni indicator, which adapts to any VHF receiver, was introduced in September of 1960 and is still under heavy backorder. Meeting a similar response, Nova-Star VHF transceivers have sold more than 4,000 units over the last four years.

Skycrafters, Inc., completing its first year as a corporation, plans shortly to introduce two more Superphones; a crystal-controlled 200-channel VHF communications transceiver and a 400-channel navcom transceiver. Under development is further transistorized equipment. Skycrafters has absorbed Aircraft Specialty Lines of Phoenix, Arizona, and will continue to market the ASL Birddog, a light aircraft radio direction finder.

In a year Skycrafters has grown from one distributor to ten.

SunAir Electronics, Inc., heretofore solely interested in high frequency transceivers, has suddenly tripled its employment and is well into development of VHF navcom systems. These include "ground direction equipment" which undoubtedly means DME, and other, unspecified projects. In March of 1961 the company moved into a new and larger plant, and from June through August sold $200,000 worth of HF communication equipment.

With its new LU-series loading coil, SunAir can eliminate the awkward trailing wire antenna so long associated with HF

DARE DADF-1A Control Panel

and get comparable range from a fixed antenna. Logical beneficiaries of this advance will be helicopter operators with a need for long range communications.

SunAir looks to 1962 and the introduction of its new units with considerable optimism, and even now, less than a year after its move to new quarters, is contemplating further expansion.

Electronic Devices Corp., in production work for the last 16 months, added a new HF transceiver to its line late in October. Unnamed when FLYING went to press, the unit is designed primarily with the heavy single-engine and light twin-engine aircraft in mind. The company, which calls its electronics laboratory "one of the best-equipped in Southern Florida", is increasing its engineering staff, and says that the picture for the future is brightening. With further navcom under development, ELDECO currently sells more than half of its total production to Beechcraft and Beech distributors, and sees 1962 as a year of opportunity for the further growth of its navcom equipment.

(Continued on page 128)

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(Continued from page 126)

Motorola Aviation Electronics, Inc. is now most firmly in the general aviation navcom field with its M-135 system, introduced in July, 1961. In the four months since it has been offered, the compact M-135 has surprised even Motorola in the response it has drawn, although company policy is not to release sales figures. The company's navcom development aims to couple its effort with its Semiconductor Division to "advance ahead of the state of the art". This development has recently introduced the M-4 automatic flight control system (see Support Equipment), and is acknowledged to be engaged in lightweight DME and is presumably also involved in general aviation transponder research.

New methods of finding the way from one place to another are under heavy research by many companies. ACF's Pictorial Navigation Display (FLYING Nov. '60) operated through a VORTAC receiver, is currently the most straightforward. A moving dot on a transparent airway chart shows the airplane's position at any moment, allowing complete and accurate air traffic control in the areas covered by the charts. A pictorial display in every cockpit would answer many an air traffic control problem, but like every other piece of machinery, it is somewhat specialized (VORTAC stations are required, as are 800 charts to cover the U.S.), and not a panacea for all the ills of air navigation. Limitations understood, pictorial navigation is a tremendous advance in the science of flight.

The Vector Analog Computer, (FLYING, May '61), which also relies on VORTAC for its basic information, began as a pictorial display, became an instrument which Butler Aviation Research considers even more effective than pictorial navigation. Using ILS-like crosspointers to represent track and distance to any selected point within range of the VORTAC station, the pilot flies a miniature airplane to his destination, the intersection of the crosspointers. As in pictorial navigation and DME, this system allows any point within range of the VORTAC to be used as a holding point reference or as the station itself.

A great deal of manpower is at work today to broaden the spectrum of all navcom for the people who own and fly airplanes. As research becomes reality, 1962 will find general aviation farther down the road toward more precise, more reliable aircraft control and its welcome companion, flight safety. END

Tri-gear Beech

(Continued from page 67)

2,200 rpm and 29 inches mp power setting, 73 per cent or 329 BHP corrected.

At 10,000 feet, a cruise speed check was made at a true power setting of 67 per cent or 300 BHP, corrected for the 63 degrees F temperature, which yielded a true air speed of 234 mph.

As the airplane was flown out over the Pacific Ocean, the temperature dropped slightly.

At a power setting of 1,750 rpm, 25 inches mp, 61 degrees F temperature at 10,000 feet, the aircraft's engines were developing 50 per cent of actual power and giving a true airspeed of 208 mph.

At 45 per cent power, 1,600 rpm, 24.5 inches mp, the aircraft achieved a true airspeed of 186 mph. At this power, fuel flow indicators showed 96 pounds per hour total consumption, or about 32 gallons per hour for both engines. With the tankage installed on N118L, the aircraft would have about 10 hours cruise.

Following the speed check at altitude, general stability and control was sampled in descent to Burbank for ILS run. At 210 mph IAS, the changed configuration showed no change in pitch, roll or yaw stability with both single and double needle width turns done passing through 7,000 feet.

The second flight, with its maximum gross weight and most rearward CG position, afforded an excellent opportunity for testing the aircraft's stability, control and handling qualities.

First work done on the second flight of N118L was another set of speed readings. Time to climb to 10,000 feet approximated 12 minutes following liftoff after a 2,500 foot ground run. Fuel flows indicated about 105 pounds of fuel burned in the climb, and temperature at 10,000 feet was 56 degrees F, 33 degrees above standard, during the speed checks. At METO power (which is 450 hp for the PACaero conversion), the aircraft used 2,300 rpm, 28 inches, mp and had a true air speed of 225 mph.

At 70 per cent power, 211 mph TAS was recorded. At 60 per cent power, true air speed was 203 mph. At 52 per cent power, TAS was 197 mph, and at 45 per cent power, 174 mph was recorded.

Pulling 52 per cent power, with the aircraft trimmed for hands-off flight at a calibrated airspeed approximating 160 mph, in clean configuration, pitch, roll and yaw displacements were made to sample the airplane's stability at altitude, gross weight with the aft CG position. A definite CG effect was felt in pitch oscillations which had a long period, wide speed and altitude fluctuation and little damping in each cycle. However, the characteristics exhibited were within acceptable limits.

In roll and yaw, effect of the test-mounted pitot boom could be felt to an extent, however the period, magnitude of cycles and altitude changes were all acceptable, with yaw showing the quickest recovery despite the changed nose.

Stalls with N118L were done at 11,000 feet in clean and landing configurations, power on and off, with a trim speed of 136 mph IAS.

In landing configuration, power off, the airplane entered initial buffet at 70 mph IAS and broke in the stall at 55 mph IAS. In the clean configuration, buffet appeared at 91 mph IAS and the break occurred at 85 mph IAS. In both configurations, handling qualities were good, the aircraft retained adequate directional and lateral control, and a power-off recovery was effected easily without too much sensitivity to accelerated stall as the nose was pulled up to hold altitude loss to a minimum.

Proper stall recovery technique of applying power as the nose falls through the horizon was used in recovery from landing configuration stall and the airplane flew

(Continued on page 131)

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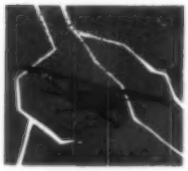

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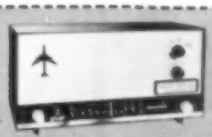

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Both the Nova/Star OMNI and the radio far out-perform my expectations... Transmit and receive loud and clear at least 50 miles at 2000 feet. *Dr. F. H. Sink, San Clemente, Calif.*

Installed the Nova/Star system in a customer's plane in January, and have heard nothing but praise of its performance since. Performs better than sets costing upwards of $1000. *Theo. Grote, Joseph, Ore.*

We consider the performance of our Nova/Star equipment excellent . . . have received many compliments on modulation and signal strength. The Nova/Star is all you claim and more. *Lt. James Hickox, San Diego, Calif.*

Reception is clear as a bell. The Nova/Star is just what small plane pilots need. *Paul Schaefer, Milwaukee, Wisc.*

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Nova/Star OMNI also plugs into these VHF radios:
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(Continued from page 128)

smoothly out of the stalled condition.

In a left, single needle-width turn the aircraft entered buffet at 70 mph IAS, stalling at 65 mph IAS, while in a right, double-needle turn, buffet started at 72 mph and break occurred at 62 mph. Landing configuration was used. In both turning stalls, satisfactory lateral and directional control were demonstrated.

Two stalls were done at 9,000 feet using METO power, one in the landing configuration, the other with the airplane clean, again from a trim speed of 136 mph IAS.

In the clean configuration, with the CG at aft limits, the aircraft flew through with a buffet occurring about 92 mph IAS and break following at about 83 mph IAS. Controllability in pitch and yaw were good, while roll control was acceptable.

In landing configuration, all other conditions remaining the same, speeds were lower for buffet and break, and controllability increased significantly, a tribute to the stabilizing effect of the extended gear.

Single-engine performance investigation was started at 7,800 feet with the left engine feathered. At this altitude, with aft CG, weight approximating 9,400 pounds and at a temperature of 58 degrees F, the airplane held altitude easily using METO power on the right engine, with airspeed at 123 mph IAS.

The aircraft was brought down to 4,500 feet where, with temperature at 62 degrees F, METO power on the right engine and its cowl flap full open, the aircraft registered a true air speed of 149 mph.

Using cruise power of 76 per cent (2,100 rpm, 30 inches mp) on the right engine, the aircraft registered a true air speed of 146 mph.

Overall, the aircraft's performance seemed excellent, considering that actual temperatures exceeded by from 20 to 30 degrees F the standard values on which specification performance is calculated.

The PACaero 9,800-pound modification is based on five kits, each of which can be installed separately, purchased in kit form or installed by PACaero, including:

- Powerplant modernization, including different ram air scoop, short exhaust stacks and other changes. There is no need to remove engines, and the ordinary Hamilton Standard full-feathering propellers can be retained or three-bladed Hartzells substituted. N118L retains the Hamilton Standard two-bladed props.
- Heater modification, including one 20,000 BTU heater in each nacelle or one in the nacelle, one in the tail.
- Wheel doors are changed to wrap-around, and strengthened.
- Horizontal stabilizer angle of incidence is increased.
- New wing tips are installed.

These five kits together constitute the 9,800-pound gross weight modification and are FAA approved for C-45G, C-45H, TC-45G, TC-45H and D18S. Installed, PACaero gives a package price of $12,995.

The tricycle gear is approved for installation on all the same models of airplanes and, if the customer wants the 9,800-pound modification and tricycle gear installed at the same time, the wheel door kit in the 9,800-pound modification is not used and a saving effected.

Tricycle gear, installed, costs $24,500. In kit form it is priced at $19,000.

The combination 9,800-pound modification and tricycle gear installation is priced at $35,595, and three weeks down time is required to complete the job.

The Super Twin Beeches, the E18 and G18, also will be STC'd for the tricycle gear in the near future, PACaero says.

Along with the 9,800-pound and tricycle gear modifications, PACaero offers two wing fuel tank modification kits, one of which raises fuel capacity to 290 gallons, the other to 350 gallons.

Designs of the Volpar tricycle gear installation and the PACaero 9,800-pound modification kit both are such as to take maximum advantage of existing parts of the airplane. The landing gear uses the same retraction mechanism as the standard gear, except that the sprocket which used to drive the tail wheel retraction now is unused, while a new double sprocket and double drive chain retracts the nose gear. Four springs are used in nose gear installation to aid retraction against airloads, since gear limit speed is increased to 160 mph with the tricycle gear.

The airplane retains much of the same fuel system elements: the hand wobble pump and primer unit can be retained. If electric boost and primer are wanted, they can be installed, but they are not necessary to get the gross weight increase. END

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Across the Atlantic

(Continued from page 63)

They reply, "Roger, November Alpha, we check your position. Moncton Air Control clears you from over Yarmouth Red 3 Sydney, Red 13 Gander, flight plan route to London. After passing Yarmouth climb to and maintain 5,000 feet. Report Yarmouth."

The clearance is acknowledged and at 1915 zebra I cross the cone. November Alpha and I are becoming better friends all the time, so as I give Yarmouth the position, I request clearance to 7,000 feet. The request is granted and I now estimate Halifax, Nova Scotia, at 2018 zebra.

My mood has lightened now. The Mooney and I have flown a total of about 12 hours including the trip from Kerrville, Texas, and I am pleased with her stability and smart response to control.

Oil consumption on the trip from Texas was about what I had expected. I made the trip in three legs. My first stop was Little Rock, Arkansas, a flight of three hours and 15 minutes from Kerrville, Texas. On the first leg the Mooney consumed three quarts of oil. If this sounds high, remember that the Mark 21's engine has Nitrited cylinder barrels. It always takes longer to run them in, but longer life results. During the total twelve-hour trip to New York, November Alpha used six and one-half quarts of oil—compared to only five on the much longer trip to London. On the last leg to New York consumption was down markedly.

The squall line is well behind me now although I know I may later encounter its northern arm which probably extends as far as Goose Bay, Labrador.

I am approaching Sydney and can see the great Gulf of St. Lawrence where it converges with the Atlantic Ocean. A huge thundercloud distracts my rubber-necking and I add pressure to the left rudder pedal and swing in a vector several miles to the right of course to miss it. But November Alpha still makes our estimate of Sydney at 2120 zebra.

I reach Gander, Newfoundland, at 2309 zebra, with all lost time made up, and I give the Gander Tower my London ETA, which is 1330 zebra. With my fingers crossed, I leave sight of land and estimate Ocean Station Charlie at 0429 zebra.

November Alpha is performing like a clock. At 9,000 feet, while I was clearing the Maritimes, I set the power at 2,050 rpm and 20.5 inches of manifold pressure. But about an hour ago I backed it off to 19.5 inches. True airspeed is 125 knots with an indicated at 125 mph.

The sun has set and as the sky begins to darken I go on instruments, and true to the weather prediction, I plow back through the north end of the squall line encountered near Halifax.

Darkness and rain have moved in like a heavy dripping shroud as November Alpha reaches 50 degrees north, 50 degrees west, about 200 miles out over the North Atlantic. I am unable to raise Gander on HF, and I am delighted to hear the voice of the skipper of Pan American Clipper 54 break in and offer to relay for me. Shannon Airport, Pan American tells me, is requesting my London estimate, which I cheerfully give as 1330 zebra, and again this message is relayed by Clipper 54.

Somewhere near 45 degrees west, outside air temperature has reached minus one degree centigrade. It is still raining hard. I don't want any ice at this stage. I have all the electrical gear except the booster pump on, and I notice the ammeter is showing a slight discharge. I need lights and pitot heat so I shut down the radio and pull the circuit breaker on the turn needle. The ammeter shows a charge. I decide to keep the radio shut down except as absolutely needed, at least until daylight. Thus I will be able to minimize the magnetic force distortion of the radios on compass readings.

Before takeoff in Boston, following a long established routine practice I swung the compass on November Alpha on the compass rose. In plotting my course, I allowed for variation and magnetic deviation of the compass, which had to be corrected also for the variation in setting between Texas and Boston. Failure to allow for variation has gotten many pilots into trouble.

At this stage I cannot help but think of the neophyte flyers who for years used to take off from Newfoundland in single-engine planes. With these who hoped to make the trip either in the spirit of daredevilry or in the hope of setting a new record, Canadian sea rescue teams were little impressed. Too many of these novice adventurers had to be fished out of the North Atlantic, and finally the Canadian government, soured on thoughtless fledglings, called a halt to single engine attempts to cross the Atlantic. Verdict: too costly. Now no single-engine aircraft are permitted to take off from Newfoundland.

In about an hour the rain has turned to snow; small, hard-driving hornet flakes that sting and stick. The outside air temperature has dropped to minus five degrees centigrade and November Alpha is carrying about half an inch of ice. Performance does not seem to be affected, though.

I am about 400 miles out now, and I could use a cup of coffee, but I will wait until November Alpha breaks through the weather. Pouring a cup of coffee at a time like this is usually a cue for old man weather to toss a few bumps my way.

At 45 degrees west, a TWA flight acts as a relay to report my position to Shannon Airport. The pilot comes back on, requesting what type of aircraft I am flying.

"Just a little Mooney Mark 21," I tell him.

"Do you have company, or are you solo?"

"Just me and the Mooney."

"Well—have fun."

Weather is clearing now and the sky

(Continued on page 134)

FUTURE PROSPECTS FOR GENERAL AVIATION

OUTLOOK estimates for general aviation are in good agreement as the best guessers in government and industry plot the curves on which plans must be made.

Airworthy aircraft in this growth industry will total about 105,000 by 1970, compared to today's 76,000-plus, barring war or depression and not counting on any great advance in the vehicles.

Aircraft-hours in general aviation in 1975—an estimated 21,000,000—will be close to double the 1960 volume. Planes will be somewhat bigger and faster, on the average. So the passenger-miles will more than double in the 15-year span.

No great change in composition of the general aviation fleet is expected, aside from a general upgrading. Number of aircraft under four-place will decline slightly while the gains are in four-place and over, and multi-engine aircraft will double and triple.

Some 200 small jets and 400 turboprops are expected within the next few years.

The Federal Aviation Agency expects airplane-hours by air carriers to hold their own while military manned flight decreases. General aviation IFR will increase fast.

FAA is taking the following steps:

1. *Airports*—The National Airport Plan would earmark funds for more than 100 general aviation fields to relieve congestion at airline terminals and get project under way before land is gone (as advocated in FLYING, Dec. 1960).

2. *Instruments*—Project Little Guy is to design an all-weather instrument panel for lightplanes.

3. *Training*—A blue shield on private pilot licenses is offered to encourage all to learn instrument attitude procedures now required for new licenses.

4. *Education*—General program to upgrade skills of general aviation pilots for safety and utility.

5. *Regulations*—An overhaul of Part 43 of the Civil Air Regulations, governing this largest branch of flying, has been initiated.

Some 90 local Air Share meetings will be held to get the opinions of airmen.

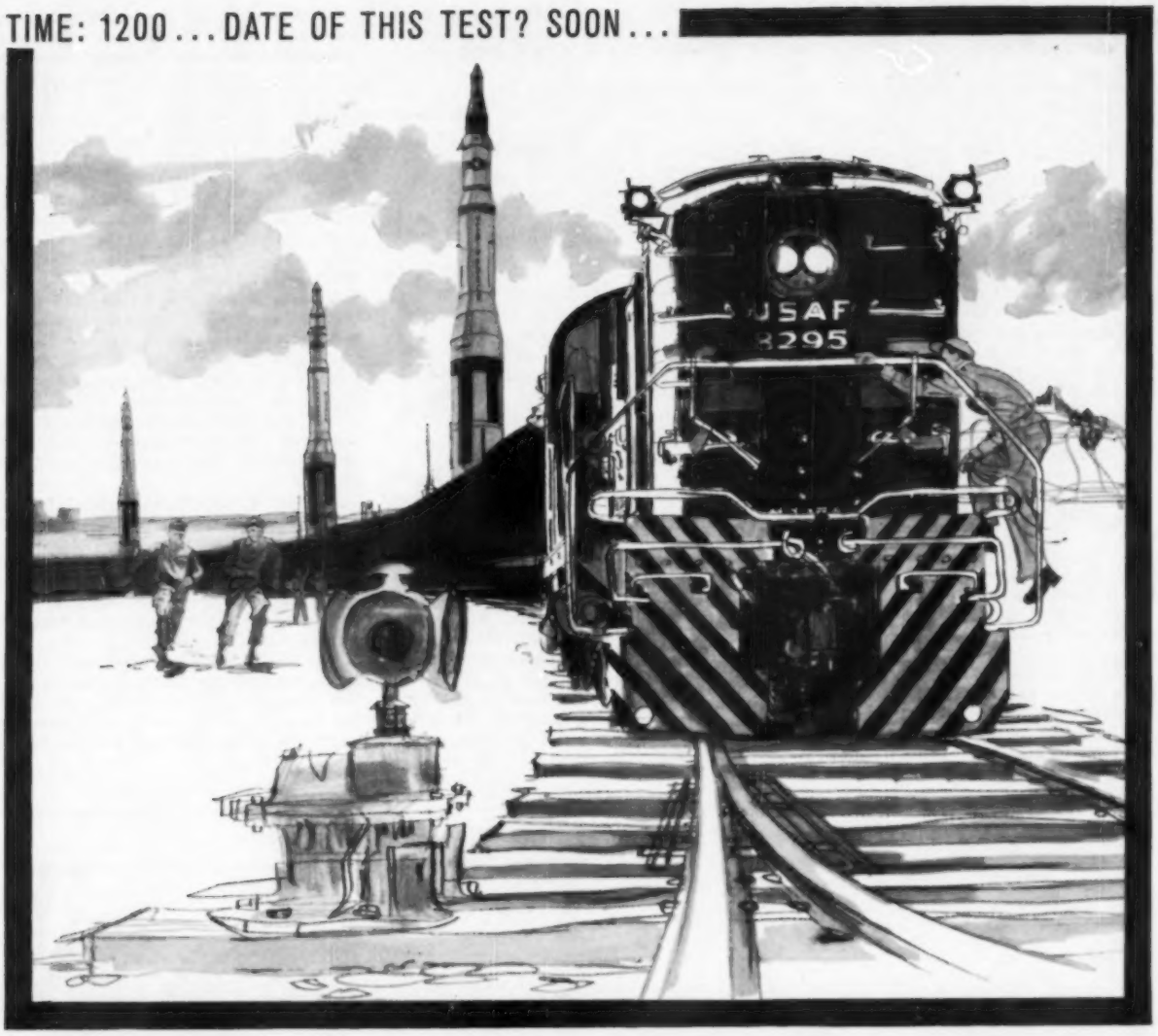
6. *Services*—Some 400 flight service stations, previously engaged mainly in message relay for IFR flights, largely for airlines, now are servicing VFR flights as their main duty.

7. *Reorganization*—Field offices and personnel dealing with general aviation will be reoriented.

On the latter point, FAA's Flight Standards Service, the Agency's largest bureau, divided its field services between operations and maintenance. In the new Southeastern Region, a division into air carriers and general aviation is being tried, each to handle operations and maintenance. If this proves superior, it will be extended to other regions.

KENDALL K. HOYT

TIME: 1200 . . . DATE OF THIS TEST? SOON . . .



. . . AND YOU'RE A PART OF SOMETHING LIKE THIS!

The day the first Minuteman missile train will roll down the track is unknown today. But the men of the Air Force who will be part of that first crew are preparing themselves right now. Of course the Minuteman represents only one Air Force project designed to make our country supreme in the air and beyond. But complex and diverse as these air and space projects may be, there is a common ingredient they cannot do without . . . men with training.

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THERE'S A PLACE FOR TOMORROW'S LEADERS ON THE AEROSPACE TEAM **U. S. AIR FORCE**

(Continued from page 132)

is turning pink. Daylight is just 20 minutes ahead and my position is about 700 miles out from landfall and about 25 minutes from Ocean Station Charlie. Now for that coffee and a sandwich. I open the coffee jug and start to pour. I have a container of coffee well mixed with broken glass.

Now I really want coffee, and landing is nine hours away. The sandwich tastes dry and I am tempted to try to drink the coffee, glass and all.

As I pass over Ocean Station Charlie and report, I give my ETA for London five minutes ahead of schedule.

The weather between Charlie and Ocean Station Juliet is breathtaking. I am at 9,000 feet and have a front row seat to a fantastically beautiful sunrise, the purest reds, pinks, and golden colors which quickly paint over the stars.

I am unable to reach Shannon on HF at 30 degrees west so I call blind on VHF. Speedbird 270 (BOAC) opens up and asks, "May we be of assistance?" They pass my position to Shannon.

A Pan American Clipper gives me a hand at 25 degrees west as November Alpha comes up on Ocean Station Juliet. At this point I get a radar plot indicating a bearing of 350 degrees true ranging 69 miles.

About 150 miles out of Shannon, I begin to see an occasional ship and hear a cheery voice answer my VHF call.

"Good morning, November Alpha. Reading you fine."

I am really pleased with the little King transceiver. Shannon requests my London ETA, which I again state as 1330 zebra.

Near the Irish coast, the weather is clear with visibility almost ten miles. Occasional clouds high up, like lazy sheep, dot the incredibly blue sky.

I am still flying at 9,000 feet. Everything seems to be sharply focused. It is that kind of a day. Down below, I can make out tiny specks in the smooth water which I know to be hundreds of small fishing boats.

I check Shannon at 1110 zebra, give them my estimate of Strumble, England, at 1212 zebra. London Airways clears me to proceed via airways Green I to Strumble, Chepstow, Woodley, to Watford at 9,000 feet. Approaching Woodley I am cleared to 7,000 feet. Visibility, as I am cleared to London approach, is 10 miles, a beautiful day.

AT 1330 zebra I am on my base leg in November Alpha, cleared for Runway 28 on London's Heathrow International Airport.

As I taxi November Alpha onto the ramp at Heathrow a crowd of people surge toward the plane; smiles, flashbulbs, shouted congratulations, and British customs inspectors, a pleasant clamor!

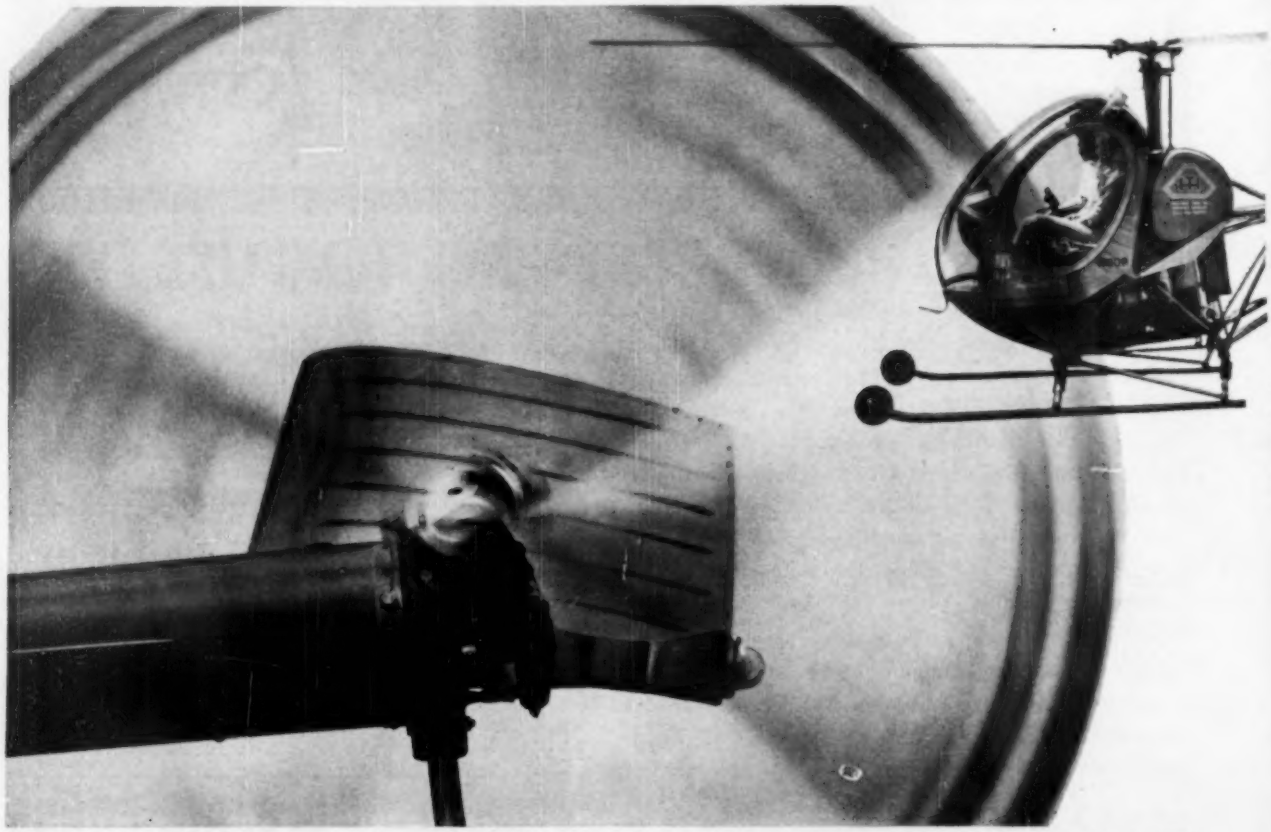
George Warcup, Heathrow Airport commandant, is the first to reach the plane and he offers his hand to me. I am grateful for the handshake and the steady arm because I am stiff from sitting so long in the same position. With the survival gear, and gasoline tanks occupying the back seat, and the passenger's seat occupied with sundry items, there has been little extra room to stretch my legs.

Lord Zetland, of the House of Dundas, ultimate owner of G-ARNA, took my arm and with Lady Zetland and others in their party we went directly to the Queen's Lounge where reporters, photographers, and writers from London's journalistic society plied me with questions about the flight. After 20 hours without something hot in my stomach, even English brewed coffee tasted good!

Mooney ARNA has flown 3,300 miles with an average fuel consumption of 6.5 gallons per hour, and I did not have a single discrepancy to report. Enough fuel remained to continue on to Rome safely. The King Radio package, VHF Transceiver and Omni proved dependable and adequate. Its range and accuracy compare favorably with much more expensive equipment.

Mooney November Alpha has given me not one exciting heart-in-the-mouth moment. She purred like a contented kitten all the way. We used five quarts of oil, about what I had expected, considering that with Nitrited cylinder walls 50 hours is about the right amount of time for rings to be seated properly.

The flight was a pleasant one, and to the members of the Logan weather station, Pan American, TWA, BOAC, and to all the men on flight watch who gave me assistance along the way, I'd like to say thanks. END



Powerplants

(Continued from page 33)

became clear in 1961 which support the prediction that a complete line of gas turbine powered lightplanes will be selling in five years or a little more. They are:

- The engines needed to bring about this basic transformation in general aviation will be ready.
- The airframe manufacturers have stepped up their effort in designing new aircraft to take maximum advantage of the gas turbine performance potential.

All U.S. manufacturers are well along in the development of so-called "second generation" gas turbine engines. They all have much better performance than the gas turbines available in the past.

Specific fuel consumption in most cases has been lowered 30 per cent or better on the new models, from the neighborhood of one pound of fuel per horsepower per hour to about 0.7 or less. The inherent simplicity and light weight of gas turbines has been improved. Most of the new engines are between two and three horsepower per pound of engine weight compared to about 1.5 on the best of the older turbine engines and less than 0.7 for good light aircraft piston engines.

Most of the "second generation" gas turbine powerplants are ready for extensive flight testing or are already flying. These include the General Electric CJ-610, the Pratt & Whitney JT-12, the Canadian Pratt & Whitney PT-6, The Continental Model 217, the Allison T64 in addition to the Lycoming T53-L-9.

Still the engine picture is not complete and some surprises are still ahead. One of them is a new family of General Electric engines, unannounced officially as of August. These are small turboprop/turboshaft powerplants which will be developed in several sizes from 250 hp to the neighborhood of 1,000 hp. They are described as "highly simplified" and will be tailored for mass production with many stamped-out parts, in an effort to make a big cut in sales price. Apparently General Electric is prepared to push the development of these engines at a very fast pace to have them ready for the first generation of gas turbine-powered lightplanes.

In addition to its planned entry into the small gas turbine field, General Electric continued development of its medium power engines. The CJ-610 turbojet, producing 2,400 to 2,850 pounds of thrust from only 355 pounds of engine weight, has been selected to power the Aero Commander Model 1121, the Swiss-American Aircraft Corp. SAAC-23 and the Israel B-101C executive transports. This engine is a commercial development of the military J85 which has a total of more than 30,000 running hours and 5,000 hours of flight time. The Aero-Commander jet is expected to fly in 1962.

The General Electric T58 turboshaft engine developing 1,050 shp for an engine weight of 280 pounds or less is flying in two Sikorsky helicopters and one Boeing-Vertol helicopter, all of which are destined for service with helicopter airlines. This engine also is used in three military helicopters.

A larger engine, the T64, is also under development by General Electric. It produces 2,850 shp at a weight of 713 pounds in the turboshaft version and 1,136 pounds for the turboprop. This engine has flown in the de Havilland Caribou and is scheduled for testing in the Grumman Gulfstream. Under current plans it will receive its FAA certification in July 1962.

Pratt & Whitney's entry into the business aircraft field, the 3,000-pound thrust JT-12 turbojet, continued to pile up hours during 1961. The light engine, slightly over 400 pounds, has been flying with the Lockheed JetStar, North American T-39 Sabreliner and the Canadair CL-41. The latest version, the JFTD-12A-2, has application to direct-lift aircraft and will fly next March with the Sikorsky S-64 Skycrane, the first Sikorsky production helicopter to have a six-bladed rotor.

The JT-12 has a diameter of about two feet; length is but five feet. It's rating is expected shortly to increase to 3,300 pounds. The JFTD-12, two of which will power the S-64, will produce 4,050 shp each, allowing the rotorcraft to lift a 20,000-pound load—better than 50 per cent of its gross weight.

Canadian Pratt & Whitney early this year began flying its lightweight free-turbine PT-6, produced at its Longueuil (a suburb of Montreal) facilities. Canada's first turboprop/turboshaft, producing

(Continued on page 136)

Hughes 269A cuts helicopter costs in half!

Facts that make the Hughes 269A your best buy: Low purchase price—only $22,500—is less than half the cost of previous helicopters. Total direct operating costs—only $9.71 per hour (or 13c per mile)—are little more than operating your car. Long-life components—rugged but simple—help guarantee years of trouble-free operation.

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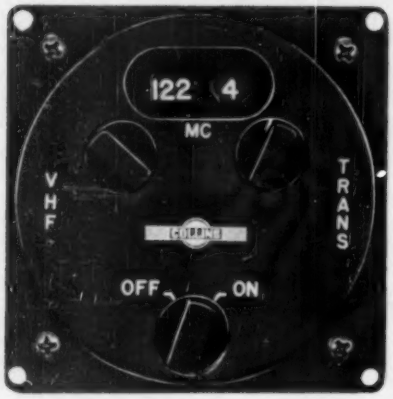

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(Continued from page 135)

500 eshp, weighs only 250 pounds as a turboprop; 225 pounds in the turboshaft version.

Small engine has completed the official 50-hour Preliminary Flight Rating Test to the specification requirements of the U.S. Navy. (Military designation is T-74.) It is now running through its 150-hour qualifications. Engine first went airborne in late May, the testbed in the nose of a Beech D-18. It has had more than 2,000 hours of development running.

Aimed at light-to-medium single- and multiengine aircraft, the PT-6 is now flying with Hiller Aircraft's new Model 1099 helicopter, company-developed for both civilian and military markets.

The Allison Division of General Motors is concentrating on readying its T63, 250 shp turboprop/turboshaft engine for the contractors selected to participate in the Army's light observation helicopter (LOH) competition. Bell, Hiller and Hughes are the companies in the competition and they are scheduled to receive engines in less than one year. The flight portion of the competition is expected to begin within two years. After this competition the T63 should have amassed several thousand hours of flight time. If the Army's plans materialize, 2,000 to 3,000 of the new helicopters will be produced after the flight competition. The combination of high flight time and large volume production could put the T63 into a commanding position in the 250 shp gas turbine engine class.

In the Boeing Airplane Co. gas turbine effort the main emphasis in engineering, production, and marketing has shifted decisively to helicopter production. Two new helicopter engines (see table for first listings), the 502-14 and the 502-18 were added to the company's listings in 1961. As a result Boeing is now offering six helicopter engines ranging from 270 shp to 550 shp. Four gas turbines for fixed wing aircraft from 325 to 550 shp are also available from Boeing.

DESIGN groups in all the lightplane companies are hard at work devising the best possible airframes for turbine engines. This sort of activity has been going on for several years but the pace is definitely speeding up. While most of the companies will keep their exact plans confidential for a few more years, general opinions in the industry are becoming clear. Today there seems to be rather close agreement on the best types of airframes to carry the new engines.

Most designers do not believe that gas turbine powered twin-engine aircraft will differ substantially from the twins now flying. When turboprops are installed, the familiar twin-engine layout used by all manufacturers will be retained. It is possible that Cessna's new Skymaster, lightlight twin with a push-pull layout will stimulate more interest in this configuration. Otherwise, few external changes are expected in propeller driven, twin-engined airplanes.

When twin-engined aircraft are to be powered by pure turbojets, the prevailing opinion among designers seems to be toward a rear engine installation with nacelles on the outside of the fuselage. The French Caravelle transport, Lockheed's JetStar, North American's Sabreliner and several other aircraft use this type of installation and it is well understood.

A radically different situation exists in the single-engine category. Several new design approaches for both heavy and light single-engined aircraft have been opened up by the gas turbine engine. The major improvement allowed by the new powerplant is a rear engine installation with no weight penalty. In the past, single-engine airplanes with pusher propellers had the engine mounted under the wing with a long heavy drive shaft to transmit power to the prop. The new turbine engines are so light they can be mounted in the tail without unbalancing the airplane. They can drive the propeller directly and eliminate the weight and complexity of the drive shaft.

AERODYNAMICALLY, advantages of the pusher propeller have been appreciated for 25 years or more. It allows a smooth, efficient flow of air to exist around the fuselage. By contrast, on conventional tractor propeller airplanes, the high-speed, corkscrew propeller wake turns around the fuselage and is responsible for a significant portion of their drag.

Another benefit of the pusher propeller is improved directional stability. The whirling propeller tends to make the airplane unstable when it is on the front of the fuselage and it is stabilizing when it is on the back end.

Since the "second generation" of gas turbine engines have made the rear engine installation attractive, a number of possible configurations are open to the airframe designer. Some of the designs are quite unusual by today's standards, but the lightplane manufacturers are evaluating every conceivable one of them.

In the final analysis the success of any of these new types of lightplanes will depend strongly upon the tail design. The empennage, in addition to stabilizing the airplane, must also protect the propeller in case of a tail low landing. The three designs discussed below are typical of those now receiving close attention from the airframe companies. They are:

- Y-tail. This empennage has three surfaces of equal length protruding from the aft end of the fuselage. One of the surfaces extends downward and would be strengthened to serve as a tail skid.
- Shrouded Propeller. In this design a large circular shroud is placed around the rear-mounted propeller. (see FLYING for April). Four moveable flaps are placed in the shroud to provide directional and longitudinal control. A feature of this arrangement is that the shroud also can be designed to greatly increase the static thrust of the propeller, so that takeoff, landing and slow speed performance is improved by a significant amount. The shrouded propeller is used in this manner on the Marvel, an Army research airplane designed at Mississippi State University. There is some argument, however, among aerodynamicists regarding the high speed performance of this design. Some of them believe that the shroud can be designed to give good performance over a wide speed range, but some disagree. Current

experimental work should soon answer this question.

● Canard Configuration. In this arrangement the wing is placed at the rear of the fuselage under the engine. The horizontal "tail" or stabilizing surface is on the nose and the vertical stabilizer is somewhere behind the center of gravity, either on the wing tips or on the fuselage. There is little doubt that this configuration is one of the most efficient ever devised for a single-engined propeller driven aircraft. Most of the fighter plane manufacturers in the world were looking at this design when jet engines appeared on the scene during World War II. Now the lightplane manufacturers are studying the canard configuration as they try to bring out a superior, single-engined, turboprop private airplane.

The high efficiency of the canard results primarily from the forward location of the horizontal stabilizer. When the airplane is trimmed out, this stabilizer produces an upward lift force. On the conventional airplane the horizontal stabilizer at the rear of the fuselage produces a downward force during level flight. This force subtracts from the upward lift of the wing. As a result, on the conventional airplane the size of the wing has to be increased to compensate for this down force. On the canard, the wing size can be reduced because the horizontal stabilizer supports part of the airplane's weight. This gives the airplane a very low drag for a given lift force and therefore a high efficiency during cruise. END

Aviation Insurance

(Continued from page 71)

insurance and covers physical damage to the aircraft. It can be bought in any of three ways.

1. All-risk ground insurance. This protects the hull against wind damage, fire, theft, ground collision; everything while the plane is not in motion under its own power.

2. All-risk ground, with taxi. This provides everything in the all-risk ground policy, plus protection while the plane is taxiing on the ground under its own power.

3. Flight insurance. This covers anything that might happen in flight in addition to all ground risks. The aviation insurance definition of "flight" is "from the moment the throttle is pushed forward on takeoff until the end of the landing roll." Under this definition, the wheels do not have to be off the ground, for flight coverage to be effective.

Q: Are additional types of coverage recommended?

A: Yes. Allied coverage is sometimes recommended in addition to the basic hull and liability policies. A policy to cover medical payments to yourself, as the owner-pilot or to your passengers. This is particularly necessary if the owner or his family do not have hospitalization or other medical coverages elsewhere.

Q: Does the aircraft liability insurance cover my immediate family or employees of the corporation owning the aircraft?

A: No. The principle here is the same as with other forms of insurance wherein you cannot sue yourself. A husband can-

(Continued on page 138)

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(Continued from page 137)

not be sued by his wife or minor children in most states.

A corporate employee is protected through Workmen's Compensation and the full legal obligation of the corporation for his injuries are provided through this coverage. This is a point that is often overlooked or misunderstood.

Q: How can I meet this problem?

A: There are numerous ways: seat accident insurance, trip accident, blanket travel accident or individual accident policy. Each case is different and has to be met in relation to what is best for that particular owner.

Admitted liability, seat accident insurance or blanket travel accident insurance is usually recommended for corporation aircraft owners to supplement Workmen's Compensation benefits when there are more than ten employees who may fly in the company airplane regularly.

WHEN there are fewer it's more economical to buy individual annual accident policies or possibly an accident policy for each trip.

Q: I've taken out liability on the passenger seats. What about the pilot's seat?

A: The only way the pilot can be protected is through his own personal life or accident or medical insurance. Very often, life insurance companies ask for a surcharge or exclusion clause when the policyholder is a pilot.

However—and here is where the aviation insurance specialist can also help out, because most regular brokers aren't aware of this—every life insurance company today will eliminate this surcharge or exclusion on application, providing certain minimums are met by the policy holder: minimum flight time, age, type of flying or the like.

In this area, there is something new just now coming on the insurance market. It's a very good pilot accident policy, covering all accidents in addition to flying, including a student-pilot, at a rate of only $5.85 per each $1,000 of coverage. The policy limit goes up to $50,000. Hospitalization and weekly idemnity can be purchased along with this new policy at little extra cost.

Q: What about costs?

A: On aircraft liability, considering a four-place aircraft, you can get good limits at about $160 per year. Ground coverage will run approximately two per cent of the value of the plane. For a $15,000 plane, for instance, this would amount to $300. For ground and taxi coverage, on a $15,000 plane, the cost would be another $45, or $345.

Another $315 would give you flight coverage, a total of $660 for all-risk ground and flight coverage. There are certain deductibles affected by the experience of the pilot, whether the plane is hangared or unhangared, the location and traffic density of the airport used by the plane as a home base and other factors, which can lower this price.

Medical payments coverage—$2,000 per seat for a four-seat airplane—will cost about $25 a year.

Admitted liability and seat accident coverage is worked out on a highly individual basis between the applicant and the company issuing the insurance, the final price being affected by the type of aircraft (one or two engines), pilot experience, and type and frequency of flight, among many other things.

Q: What are some of the tips for would-be buyers of aviation insurance?

A: Start off with the basic thought in mind that nothing is standard. What applies to one company doesn't necessarily apply to another with respect to either rates or coverages.

Deal with a specialist. If you're a marginal risk they can often work out special arrangements with the insurance companies, knowing the field as they do.

"In general," says Berlow, "aircraft liability insurance is comparable in cost with that for automobiles in metropolitan areas. To insure a plane itself against physical damage, however, runs much higher than similar insurance for cars."

What is the most prevalent cause of aircraft mishaps resulting in the larger insurance claims?

"Weather. Pilots with limited experience trying to push ahead regardless of conditions. Most of our in-flight problems arise here. The most important thing a pilot can learn is to execute an 180-degree turn out of marginal weather."

On the ground it's taxi accidents, with windstorm running a close second. Theft of easily removable radio equipment runs third in aircraft ground claims frequency.

Are there any particular class of pilots rated by the insurance company as worse risks than others?

"Crop dusters have to pay very high premiums, even though their record, particularly among the real professionals, is good.

"There's sports parachuting. That is, liability protecting the airport or aircraft owner if someone jumped and was hurt or killed or caused damage to persons or property. We have obtained quotations on this type coverage from Lloyds, but the premiums are very high. Most companies won't touch it.

"Actually, it's just a matter of time until they become educated to the fact that in capable hands skydiving is an insurable risk. We're now trying to establish reasonable rates. This is essential for this rapidly-growing sport because present policies offer very little or no protection at all.

"One company here in the U.S. does offer a blanket accident and liability policy for the sports jumper."

IN selling aviation insurance, Berlow works most closely with aircraft dealers, who are also usually fixed base operators as well. When they sell an airplane, they'll usually call one of the aviation insurance specialists to make sure their customer receives expert, uncomplicated service. When called by such a dealer, Berlow often works out all the details over the telephone, completes the transaction by mail. In other instances, where more involved analyses or procedures are necessary, he or one of his associates, will fly from Teterboro to the airport where the client is waiting. Very often the client will fly into Teterboro and park next to the office to talk personally with Berlow, Robert Glinane, vice-president of the organization, or Charles Kilian, another salesman. END

Why Aircraft Cost Money

(Continued from page 44)

3,000-plus Model 47 type aircraft in the past 15 years (world's first commercial certificate was awarded March 8, 1946). Production includes 14 different commercial models plus military configurations.

Look at this cost comparison. A bracket for the helicopter (a small, simple appearing sheet metal part) initially costs $.06; this is multiplied many times over through the processes of shearing, drilling, deburring, forming, priming, and various inspections during these operations. Final cost of the bracket is about three dollars—50 times its material cost.

One of the largest parts—a machined-detailed yoke—starts as a raw forging with a material cost of $36.61. This part is machined by turning, drilling, grinding, milling, forming, reaming, boring and various finishing operations. Some 15 man-hours are involved in its manufacturing cycle. List price of the part is 10 times its original value as a raw forging.

In the assembly of Bell's helicopter and its components, an individual inspection stamp is required on 2,600 separate operations. Each part in a helicopter is reviewed by an inspector a minimum of eight times as a detail part and at least four more times after installation in the helicopter. Pilot acceptance is dependent on satisfactory performance through all operation parameters.

Roughly, 3,000 firms supply Bell's operational needs. Subcontractors—which furnish helicopter parts to a Bell design and identity—number approximately 75. Flight check time varies from 2.5 to 10 hours per production helicopter; testing requires about 20 man hours. (Experimental models, of course, require many, many more hours.)

Bell Helicopter's employment is approximately 3,200, of which production personnel number 1,050; quality control totals 140, and supervisory over these two groups number 125. Other personnel groupings include 275 people in tool design, fabrication and cribs; 250 in plant protection and maintenance; 525 in engineering; 525 in administration and 300 "miscellaneous."

Employment is dispersed to four separate facilities combining floor area of 731,000 square feet (of which 235,000 square feet is for production). Two leased warehouse facilities bring total square footage in the Dallas-Fort Worth area to 745,000.

Man-hours producing the Model 47 series varied. The 47G series (open tail boom design) are produced for about 2,000 man-hours. The 47J series (enclosed tail boom design) for about 3,000 man-hours. The company's quality control department is staffed by some 130 inspectors, 35 supervisors and staff and about 10 clerical people. Also, there are Navy inspectors for the military and FAA inspectors for civil products.

There are also other expenditures involved with selling, after the aircraft has been produced.

An educational program has been established to aid and educate prospective customers, plus the government regulatory organizations. A sizable company expenditure is involved. Also, Bell has operated a pilot and mechanic factory training school at a loss since 1946. Service representatives

(Continued on page 140)

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(Continued from page 139)

are based throughout the world.

Industrial activities have been developed with organizations in petroleum, agriculture, air mail service, forestry and public utilities. Expansions also were made to the corporate market, ranching, air taxi or short haul and private owners. Additional expense was necessary to help develop heliports and modernize city ordinances to permit helicopters to operate effectively.

Bell does expect, within the next few years, a rapid downward trend in costs. Reason: the marketing of light, turbine-powered helicopters designed for low manufacturing costs and high production rates.

Note that a typical aircraft learning curve of 80 per cent, if applied to quantities such as the automotive industry, would result in dramatic unit cost reductions. (An 80 per cent curve means that each time you produce double the units, your unit man-hour cost is 80 per cent of the unit cost at the point which was doubled.)

In a helicopter there are more than 4,000 different categories of items (gears, rivets, screws, etc.) and thousands and thousands of individual pieces that make up the light, utility rotorcraft.

Extending high and low volume production of aircraft, plus uses, to support equipment, another contrast can be made. A good auto radio might cost $85; contrast this with cost of an airborne nav/com package approved for operation under FAA instrument flight rules. Similar comparisons could be drawn between the aircraft powerplant and the auto engine, and their respective systems and accessories.

Add to this the high quality materials, closer tolerances, more rigid control demanded in the construction of aircraft, the safety standards involved, including exacting government requirements—all of which, coupled with factors set down in this article—dictate the cost of today's aircraft. END

I Learned About Flying

(Continued from page 78)

down ensued before I managed to unglue my eyes from these two life-saving instruments long enough to locate the altimeter. When I found it and the remaining flight instruments, I was flying straight and not very level at about 2,300 feet still in the "soup". After a short quieting down period, I pointed out to sea, slowly let down out of the overcast, and made a 15-degree banked turn back toward San Diego forgetting all about the fishing boats I had been trying so hard to impress.

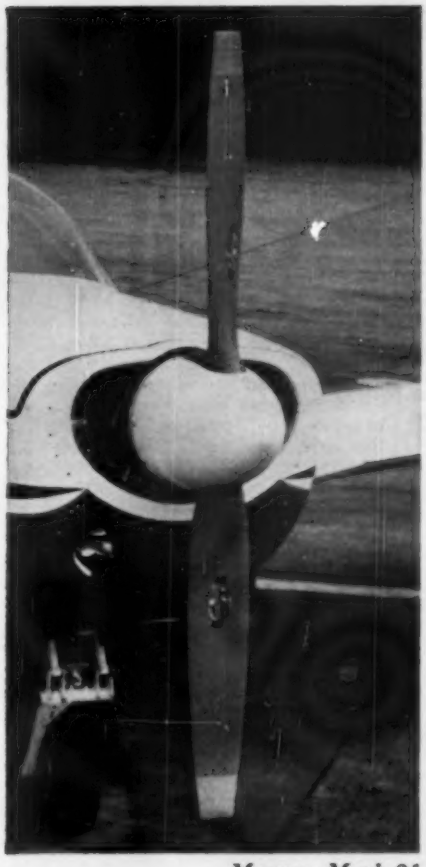
Getting out of the airplane that Saturday morning, I didn't jump off of the wing in my customary "hot-pilot" manner. My legs were so rubbery that had I jumped, someone would have had to scrape me up off the concrete mat.

In addition to showing me the foolhardiness of flat-hatting, this experience taught me two lessons about instrument flying I will never forget.

I will always establish an instrument "scan" *prior* to entering instrument flying conditions and in no case will I intentionally enter instrument flying conditions in an "unusual attitude". END

Cessna 210

Piper Comanche 250



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Who buys, Who Flys

(Continued from page 65)

I was astounded to learn that 20 per cent of the members present were active pilots, representing almost every business and profession around the courthouse square. A check of aircraft registrations in one Kansas county disclosed over 80 different businesses and professions using private planes for business travel.

Who buys these high ticket items? What are the uses? What does it cost?

There are basically five markets for the aircraft that comprise the general aviation fleet. First, there is the market for the company-owned plane that is flown by a professional pilot. This equipment is often multiengine and one of several planes in a company fleet. Some 90 per cent of the so-called "big corporations" of America own and operate such a fleet. Ninety-two per cent of the multiengine aircraft in this category are equipped for instrument flight conditions, carrying generally the same instrumentation as the airliners. This plane hauls the big man of big business.

The second market is, again, for the company-owned plane, but this time it is not flown by a professional pilot. It is flown by me, by the salesman, by the junior executive. This plane hauls a smaller man of big business, or, more often, it hauls a big man of small business, the owner, the independent operator, the member of a partnership, the rancher, lumberman, miner, or oil producer. Equipment is usually single-engine, carrying four persons, and cruising at from 120 to 200 mph.

The third market is represented by the man who does not have a company plane available, so he buys one from his own resources. He uses it for personal travel, but still has enough business use to warrant a partial tax write-off, using one of the three standard methods used for depreciating aircraft flown for business use.

The popularity of joint business and pleasure use is seen in the growing membership in organizations of pilots within specified professions or businesses. The National Assn. of Flying Physicians recently held its annual fly-in get-together. The National Assn. of Flying Osteopathic Physicians sponsored a seminar on aviation medicine in Des Moines last winter. The National Flying Farmers Assn. has clubs throughout the United States and Canada. Flying lawyers who call themselves the "Legal Eagles" held their first national convention last year.

A small but old and highly respected association is the "Sky Pilots," made up of clergymen who use aircraft to minister to congregations in sparsely settled areas of North America.

The fourth market is for the plane which has no business use. It is flown strictly for pleasure and sport. The family uses it to see the Alma Mater play football on Saturday afternoon; Dad uses it to find that out-of-the-way fishing hole; or it provides transportation to Grandma's house on Thanksgiving Day. It may be used for no more than a Sunday afternoon spin around the "patch," getting no farther from the local airport than the established traffic pattern.

The pleasure market for new equipment is limited because of the high ticket nature of the item. But, it presents a challenge to the aircraft industry—to produce a product within reach of the mass pleasure market, either through a new method of fabrication or through new materials.

In the fifth market, the plane is not used for transportation. It becomes a specialized tool in the hands of the operator and accomplishes a specified job. An aerophysics company in Minnesota seeks out sulphide deposits, using airborne electronic equipment. It can find the deposit as much as 300 feet below the surface, and do it for less than one tenth the cost of a comparable ground survey. A state agency reports cutting highway survey costs from $1,500 per foot to $300 by use of aircraft. END

Business Flying in Canada

(Continued from page 55)

aircraft to keep a close check on widespread holdings throughout the vast Canadian west.

Cattle farmers report that without planes they would require seven times as many men to handle their thousands of cattle. Using airplanes on the prairies and in the Rocky Mountain foothills, it is easier to spot cattle far from the main herd. One flying farmer with three widely separated ranches uses four aircraft, checks thousands of cattle in a couple of hours flying time and every year saves more than 25 straying cattle. At $200 per animal, this more than pays for the use of the aircraft.

Grain farmers use aircraft to mix the air when there is frost on the ground and the upper air is warmer, thus saving the crop. Flying farmers do a great deal of their own crop dusting, and also use their aircraft for keeping social engagements with farmers hundreds of miles distant.

The airplanes also are used by them to check fences, water run-off conditions, flooded areas, drainage and irrigation systems. They can move farm hands quickly by air for special jobs, and use airplanes extensively to hunt predatory animals like foxes, coyotes and other animals which destroy crops and kill cattle.

Canadian veterinarians use planes, especially in winter when roads are blocked by snowdrifts. They can quickly answer an emergency ranch summons with their aircraft. Farm machinery salesmen make their rounds by air, and thus are able to cover more ground than by car.

Businessmen in Canada find that they can save considerable time by using their own aircraft, especially in reaching smaller cities far from scheduled airline service. Even on flights south of the international border, business executives can save time flying their own airplanes by eliminating plane changes at major cities for airlines serving smaller cities. Though some business firms have found that their total travel costs are about equal whether using company aircraft, scheduled airlines or automobiles, executives arrive for meetings with customers and business associates less fatigued than if they had

traveled by commercial airlines and car.

Most business aircraft used in Canada are imported from the United States. Single and twin-engined Piper, Cessna and Beechcraft are most popular. There are a number of Aero Commanders, converted DC-3s, turboprop Fairchild F-27 and Grumman Gulfstream aircraft. Lockheed JetStars are the first all-jet aircraft now being delivered in Canada. British-built Beagle-Auster single-engine aircraft, twin-engine de Havilland Dove and turboprop Vickers Viscount aircraft are also being used in Canada, along with Canadian-built de Havilland Beaver and Otter single-engine airplanes, as well as twin-engine turboprop Canadair 540 executive aircraft.

The number of registered business aircraft has almost doubled in the past few years. The Canadian Business Aircraft Association was formed last year to represent business aircraft owners in government regulatory negotiations and with airport authorities.

The association recently held its first annual convention at Toronto to study the needs of the more than 150 companies using one or more aircraft for business purposes.

Growth of business aircraft in Canada is also measured by the number of new organizations which have developed in the past years to service business aircraft. At the big international airport in Toronto, there are now five companies whose major business is servicing company aircraft, renting aircraft with or without pilot to business firms, and selling executive aircraft. At Montreal there are two such companies, while others are located at Calgary, Edmonton, Halifax and St. Johns, Quebec.

At Toronto several of these companies have just completed multi-million dollar hangers and overhaul facilities.

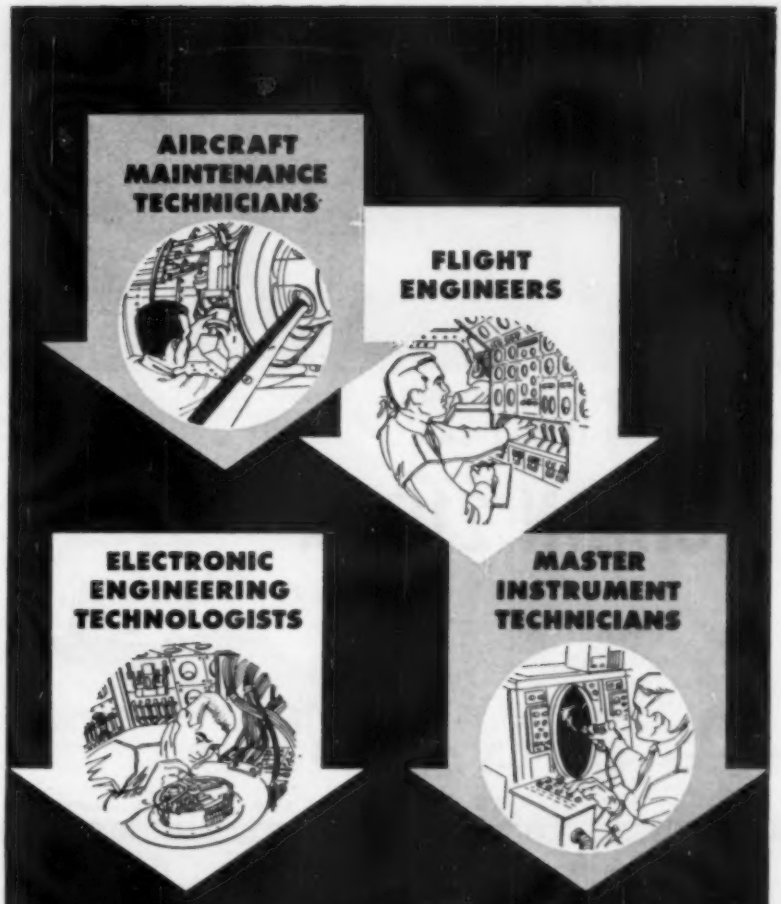
A few of Canada's larger companies maintain their own service hangars at Toronto, have their own group of pilots to operate their fleets of aircraft.

There are some 5,000 aircraft registered in Canada, of which about 2,000 are used by commercial scheduled and non-scheduled airlines and by provincial government air services. Of the 3,000 non-commercial aircraft, it is estimated that about 1,000 are owned by firms for various business uses. The rest are pleasure aircraft.

While Canada's population is about one-tenth that of the United States, its use of aircraft is nowhere near that percentage. In the United States about half the non-airline aircraft are used by business firms; in Canada about one-third. The United States has about 6,000 airports for the use of business aircraft; Canada has only 500, and uses many lakes in the northland for float-equipped airplanes.

In Canada business aircraft mainly have been used in past years for flying personnel to natural resources development sites.

Business firms, large and small, are just beginning to utilize their own aircraft for intercity business travel. Judging by developments of the past two years, many business aircraft will be sold in Canada in the near future. END



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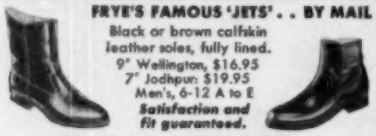

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Support Equipment

(Continued from page 41)

High in this category are the seaplane floats manufactured by the Edo Corporation of College Point, New York. The company has been converting landplanes to seaplanes since 1925. Now building a complete line of standard and amphibious floats, Edo's latest installation is designed for the Piper Cherokee, will weigh 243 pounds, cost $2,828 installed.

In Minneapolis, Minnesota, Federal Ski and Engineering Co. claims to produce the most complete line of aircraft skis in the world. Having designed and manufactured the majority of all such skis in the North American continent, Federal hydraulic wheel-skis, manual wheel-skis, and wheel-replacement skis equip almost all aircraft eligible for ski installation, from light airplanes to 80,000- to 100,000-pound transports. Also in operation since 1925, Federal has recently received FAA approval of all three types of ski for the Cessna 185, and is presently at work on development of skis for later-model aircraft.

Wing tip fuel tanks are manufactured by Flight Extenders, Inc., of Stamford, Connecticut. The 12-gallon tanks fit the Beech Debonair and extend its normal range by 400 miles.

In the same line, Brittain Industries, Hawthorne, California, offers two 15-gallon tip tanks for the Piper 250 Comanche, two 20-gallon tip tanks for the Navion A through G aircraft and all Beechcraft Bonanza airplanes. With the tanks giving a tip-plate effect, stability is actually increased, stall speed is lowered by three to six mph. Bonanza tanks sell through Beech distributors for $1,190, Comanche and Navion kits sell for $995, include flush aileron balancing modification as part of the kit.

The Woodward Governor Corporation, Rockford, Illinois, manufactures a propeller unfeathering accumulator system for all Cessna 310 models and the Piper Apache. Selling for approximately $400, the system should shortly be approved for Twin Bonanza and Aero Commander aircraft. Early in 1962, Woodward plans to introduce an automatic electronic propeller synchronizer that will not only synchronize, but synchrophase propellers to within 15 degrees rotation of each other.

Harms Industries, Inglewood, California, is producing a vacuum pump that replaces venturi systems in Cessna 170 and 172 aircraft. A four-pound unit connecting to the engine generator, it has gyros running as soon as the engine starts, costs $229.

Offering lightweight pneumatic wing and tail deicing and claiming the only presently-available electrically-heated propeller anti- and deicer is B.F. Goodrich Aviation Products, Akron, Ohio. Available for virtually any light-twin airplane, installed kits (using hardware produced by Bendix' Utica Division) weigh 50 to 60 pounds, operate up to six hours from a self-contained air cylinder pressurized to 3,000 psi.

Just entering the general aviation field is the Aviation Products Division of the Goodyear Tire and Rubber Company, also of Akron. Currently in the process of gaining FAA approval, the company's electri-

cally-heated wing and tail leading-edge blankets are under consideration by several aircraft manufacturers. In final tests are electric propeller deicers for Aero Commander, Beech, and Cessna twin-engine aircraft. The propeller units will operate from existing generating equipment aboard the airplane, but it is probable that wing and tail electric deicing equipment would require an additional source of current.

Scott Aviation Corporation, Lancaster, New York, now produces a substantial line of aircraft accessories, but is primarily known for its portable and console oxygen equipment. Scott builds high-pressure installations, up to and including its $295 President console for larger general aviation aircraft.

Zep Aero Corporation, of El Segundo, California, will be introducing this month a new five-place manual-control oxygen console for general aviation airplanes. Due to appear near the first of December is a lightweight filler-valve oxygen system, allowing service from an external oxygen cart, rather than requiring removal of cylinders for filling. New too is a "less than $100" oxygen field test kit that, with the exception of demand regulator systems, checks performance of all types of oxygen equipment now in general aviation use.

A great amount of flight-aid type support equipment is available for instrument panel installation. These include Garwin Inc. instrument system (FLYING, July 1961), which is being installed on all 1962 Mooney airplanes. The Wichita, Kansas company's "combined instrument" idea has led Mooney to call it "one of the great advances in the simplification of instrument flying." The instruments carry a one-year warranty.

Other ideas include the Coffing 3-D Horizon (FLYING, September 1960), which makes aircraft attitude visualization simple for the least experienced pilot. Latest from Coffing's Covington, Indiana plant is its Stratographic Horizon Indicator, a blue-sky, section-lined attitude gyro with bank and climb-dive references.

THE Vecto Corporation of Houston, Texas builds the Vecto Flight System (FLYING, October 1960), an attitude reference indicator coupled to a computor. The system shows the correct amount of pitch and bank for maximum performance twin- and single-engine operation, in all phases of flight.

A backup against the possibility of complete electrical or vacuum failure on instruments is the Waltham turn indicator, manufactured by Waltham Electronics Corporation, Waltham, Massachusetts. Battery-powered and completely self-contained, the portable unit sells for $95.

Autopilots and automatic flight control systems include some of the most sophisticated support equipment, and their popularity is on the increase among general aviation operators.

Sperry's Phoenix Division, which announced its SP-3 three-axis autopilot a little more than a year ago, has now sold over 100 of the $5,190 units to general aviation. The company will introduce automatic coupler units shortly that will operate the SP-3 through ARC's CD-4 course director system. Later plans call for a full radio beam coupling to allow complete automatic ILS approaches. Sperry is taking "a good hard look" at electrical flight instruments, specifically gyrosyn compass installations, to determine their adaptability to general aviation airplanes. A test unit has already been installed and flown in a Piper Tri-Pacer owned by the Sperry organization. The company's universal automatic pilot (FLYING, March 1961), under development for the Army, has the capability of flying complete automatic approaches in both fixed- and rotary-wing aircraft. The five-axis unit will soon fly a demonstration for Army officials, and civilian application of the unit is a long-term possibility.

The "natural" look for instrument flying, from Lear, Santa Monica, California, has made the Lear Command System an item of increasing popularity. This system, known as LIFE (Lear Integrated Flight Equipment), consists of an integrated three-axis aircraft attitude indicator and flight director called NaFli (for Natural Flight), and the Lear Situation Display, a graphic map-type presentation of the airplane's path in relation to a chosen radio beam. These two instruments supply the necessary flight and ILS information to the pilot. NaFli has stirred interest in both fixed-wing and commercial helicopter fields. The information it presents can be flown manually or programmed into an

(Continued on page 146)

Jules Manger, Jr., Chairman of the Board, Manger Hotels, is seen with his wife and two of their seven children, all ardent flying enthusiasts.

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(Continued from page 145)

autopilot. Mitchell Industries Inc., of Mineral Wells, Texas, produces two styles of autopilot sold in Piper Aircraft and three under its own banner (FLYING, April 1961). Priced from $995 to $3,245, the Mitchell units provide one- and two-axis control through a transistorized electric servo system.

Mitchell's heaviest unit weighs eight pounds.

Latest from Motorola Aviation Electronics, Inc., Culver City, California, is its three-axis M-4 automatic flight control system (FLYING, October, 1961). Built for airplanes of less than 12,500 pounds gross weight, the M-4 has automatic pitch trim sequencing to avoid sharp attitude changes when the unit is engaged or disengaged. It couples to the ARC CD-4 course director to allow omni radial tracking and complete ILS approaches. With a red REVERSE light to warn when it is set for back-course approaches, the M-4 sells for approximately $9,000.

The Tactair T-101, product of the Tactair Valve Division, Aircraft Products Co., Bridgeport, Pennsylvania, is the latest arrival on the autopilot market. Selling for $495, the unit has single-axis (roll) control and a heading lock feature. Main product of the company is the T-3 autopilot (FLYING, June 1961), a pneumatic, two-axis (roll and pitch) unit approved even for twin-engine aircraft under single-engine conditions. The T-3 has a one-year warranty, sells from $2,950 to $3,685.

The Brittain autopilot (FLYING, September 1961) also uses a pneumatic system. Its two-axis (roll and yaw) control allows coordinated turns, features a self-contained gyro making it independent of the directional gyro and attitude indicator for control information. Prices vary from $895 to $1,395.

The Kollsman Instrument Corp., a subsidiary of Standard Kollsman Industries, Inc., is manufacturing a full line of flight, engine, and navigation instruments. Latest in the Elmhurst, N.Y. company's line are "bookshelf" type vertical instruments developed primarily for military use. Though currently somewhat more expensive than standard instruments, they would be available for light aircraft on sufficient demand.

In the field of ground support equipment, King Radio Corporation of Olathe, Kansas offers a ten-watt unicom system. Available in any frequency from 118.0 to 127.0 mc, the KG-300 operates on 115 VAC, has single-channel crystal control.

Skycrafters Inc., of Long Beach, California, sells its AM-122 Multiphone for $395. Another single-channel crystal-controlled unicom, it has a five-watt output, is available in any frequency from 118.0 to 132.0 mc, operates on six- to 12 VDC, 115 VAC.

Nova-Tech, Inc., of Manhattan Beach, California has recently announced its four-band model 711-WN home receiver. Its tunable aircraft band covers 108.0 to 130.0 mc, operates on 115 VAC. In a decorator-styled cabinet, it sells for $100.

The field of support equipment stretches on and on. In its vastness it reflects a greater understanding on the part of manufacturers that, from private airplane to corporation fleet, general aviation is a vital business preparing for another great cycle of growth. END

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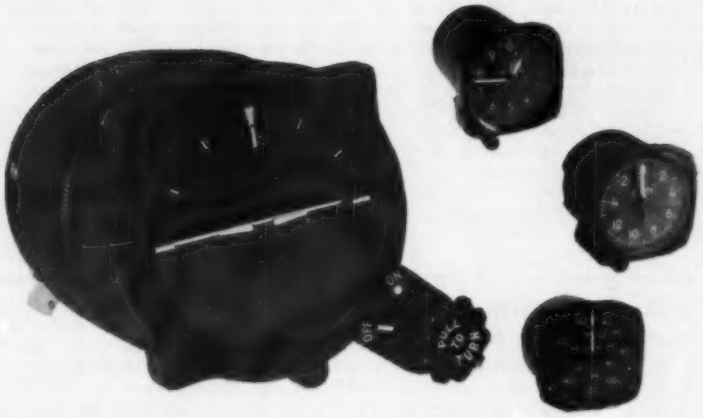

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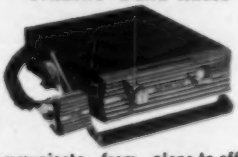

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The recorded material is brought down and edited to provide cross-sectional coverage. A narration is then written to clarify and explain the recorded-in-flight material. Thus the dialogue and actual experiences are true to life.

The material is further checked and verified by several flight instructors and experts on the subjects recorded.

Next step is recording of the material at the Capitol Record studios in Hollywood. NBC staff announcer Vincent Pelletier is the man behind the voice on all recordings.

In order to select the basic elements for any record and the flight experiences to be illustrated, some 7,000 pilots are surveyed as to the material they would like included.

Then several flights are made with two pilots and the recording expert. They fly the route to get the "lay of the land." Finally after these dry runs a detailed outline is written. After this actual recording flights are made.

The result is a series of records that allow the student pilot to remain in the comfort of his lounge chair while listening to the true experiences he is likely to encounter in flying, plus a narration explaining their significance.

Luck of the Irish

(Continued from page 76)

New York to Paris. The greatest benefit arising out of Mr. Orteig's offer, however, lay in the fact that it stimulated interest in the westward crossing for the first time. And attempts continued to be made until the feat was ultimately accomplished, even though the Orteig prize had already been won.

After a most discouraging series of fatalities and failures on these westward attempts, one of which I shared with my old friend, Capt. R. H. MacIntosh, of old Imperial Airways fame (ours was the last of the 1927 attempts) I found myself lined up with Capt. Herman Koehl (and Baron von Huenefeld, who rode as passenger) at Baldonnel Airport, Dublin, in the early spring of 1928. There was but one other entry: my old friend Hinchcliffe and his sponsor, the Hon. Elsie MacKay, daughter of Lord Inchcape, the wealthy shipping magnate, who had decided to accompany him.

Hinchcliffe and Elsie MacKay, flying the American Stinson aircraft "Endeavour," took off from Cranwell Aerodrome, England, on the morning of March 13. They were last seen flying out over the Atlantic at the extreme southwest corner of Ireland and were never seen or heard of again.

The assaults on the westward crossing now claimed three machines and seven lives, in addition to defeating the attempts of three worthy aircraft, whose crews had been compelled to give up and return in the face of extremely adverse weather conditions which are meteorologists seemed completely incapable of forecasting.

The job was now entirely up to Koehl and myself, as the original ardour seemed to have completely cooled off.

I was absolutely infatuated with our machine, the "Bremen," from the first moment I handled her. She was a full cantilever, all-metal, low-wing monoplane of the usual contemporary Junkers construction and the type—W33—had been specially designed for freight carrying. She was powered by a simply designed, six-cylinder in-line water-cooled Junkers L5 engine developing around 310 hp. The cockpit was neatly cabined, giving her an extremely pleasant and clean line. She was what she looked—a beautifully stable aircraft, possessing the most perfect flying characteristics.

After receiving what seemed to be a favorable weather report on the evening of April 11, to which a confirmation came through about midnight, we were on parade well before dawn of April 12. But owing to an abnormally long downpour of rain lasting several days, the aerodrome was still pretty sodden, and there wasn't a breath of wind to aid the takeoff of our heavily overloaded aircraft (we were carrying a load of just over three times the weight of the machine empty). No beautiful concrete runways existed in those days and our takeoff strip seemed to be smeared in a dense layer of viscous glue. Regretfully we unloaded 60 gallons of fuel.

Feeling beforehand that such conditions would exist, we had removed a stone wall on the western boundary of the aerodrome which extended our mile long runway by almost another 500 yards. This proved to be a most fortunate and wise decision.

The "Bremen" was lined up on a concrete apron on the eastern boundary of the aerodrome. Her tail was held up in flying position on a two-wheeled dolly and was secured by the tail skid which was slipped under a heavily greased metal strap. As soon as the machine became airborne, the dolly automatically dropped off.

Each 100 yards of the runway was marked by a numbered 50-gallon drum, the last painted red. If we had not attained a certain airspeed by the time we had reached this drum, we were to cut the throttle in order to avoid crashing into the trees marking the extended boundary of the aerodrome. We had no wheel brakes and, of course, flaps had not even been heard of then.

As we jammed open the throttle, we gathered speed very quickly over the concrete apron and the small bricked-in piece of runway which we had lengthened slightly with the aid of some old railway sleepers bedded into the clay. Speed, however, fell off as soon as our wheels got onto the grassy upslope which extended somewhat over more than half the length of the aerodrome. It picked up slowly, however, and we gathered increasing momentum as the aircraft cleared the top of the upslope and started running slightly downhill towards the final boundary.

I was congratulating myself when, horror of horrors! through some crazy piece of Irish forgetfulness, a huge sheep strolled straight into our path and stood staring, as though fascinated by the approaching aircraft. This called for a split second decision if everything were not to end in instant disaster. I eased the control column back, clearing the sheep, but as I had not reached full flying speed, the machine sank slowly back onto the floor. The hedgerow in front appeared to be three times its height. It was a most sickening feeling.

There was nothing to do now but hold it down almost beyond the last possible fraction of a second, when I eased the control column back, became airborne, and I was told long afterwards by eye witnesses we literally touched the tops of the stunted oaks with our wheels as we passed over.

The Bremen was sinking slowly, just on the verge of a stall, when a conical-shaped hill appeared dead on our track, 'round which we edged in a very gentle flat turn, with the left wingtip almost touching the side of the hill. We were clear and still flying. The slightest splutter of the engine during those critical moments would have been the end of the whole venture in an imperial holocaust in the hedgerow or the adjoining hillock.

Frankly, I had looked forward to this part of the enterprise with fear and trepidation. Yet during the actual job itself our nerves were so tensed and our minds so fully occupied that we felt as cool as ice.

Out over the ocean, the weather was very assorted, and the sky almost completely overcast, so that any attempt at celestial navigation was completely out of the question. Our navigation would, therefore, be described as dead reckoning. In actual fact, we more or less smelt our way across. During the day, we did three-hour spells at the controls. At the end of each spell, we dropped smoke bombs at stop-watch intervals on to the surface of the ocean. Turning back on our tracks, we resumed course over the smoke bomb puffs, got a drift check, the wind direction and velocity, and a pretty fair estimate of our ground speed and DR position. When we found we were flying into a headwind, we dropped down to about 50 feet of the ocean surface where this retarding force was least strong; and with a following wind—a rare occurrence—we climbed to about 1,000 feet to take full advantage of it. So it went on all during the day in an amazing diversity of weather conditions, our passenger supplying us with food from between the main fuel tanks in the cabin behind.

After the sun had overhauled us at our midday position, it seemed to become jet propelled as it disappeared into the west

(Continued on page 150)

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(Continued from page 149)

behind what we believed was a large mountain range on the American mainland. It later, transpired it was a very large ice-forming storm area reaching up to about 20,000 feet, which was a source of immense trouble and danger that night.

We reached the region of the Grand Banks of Newfoundland as night was beginning to fall. It was clearly defined by a great bank of fog reaching from the ocean surface to about 3,000 feet. We climbed over the fog and soon became caught up in the blackness of night as we struck the fringe of the storm area. All our fond hopes of locating the lighthouses along the Nova Scotia and northeast American coasts now were gone right down the sink. Had we not hit such ferocious weather conditions, the flight down to New York would have been just a nice cup of tea.

WE climbed to 6,000 feet and continued flying in a westerly direction, rocked and buffeted by the storm area. We were reduced entirely to instrument flying, if it could be dignified by such a name. Koehl and I alternated at the controls at half-hourly intervals. At the end of each spell we were completely exhausted, both physically and mentally, and we had the feeling the instruments actually were grinning at us. We had to rely entirely on a very inadequate small bowl-type magnetic compass, a very primitive type of bank and turn indicator, an airspeed indicator, altimeter and engine revolution counter. Primitive as it was, we could never have weathered that filthy night without that bank and turn indicator. It was our absolute salvation. Whenever I look at the instrument panel of a modern airliner, the experiences of that particular night are recalled to my memory with the feeling of horror.

We decided to alter course to the southwest, in the hope that we could get out of the storm area and, once in the clear, alter course again to the west and come in over the Nova Scotia coast. We carried a large-sized thermometer secured to the outside of the cockpit, which had to be watched carefully. Soon, we were icing up rapidly. As no de-icers existed in those days, the only thing to do was to come down to a lower altitude and get out of the freezing zone. This we did with satisfactory results, but on one occasion we almost flew straight into the raging ocean below. Once, the venturi tube operating the gyro of the bank and turn indicator froze up and put the instrument out of commission. Fortunately, we had anticipated such an occurrence and carried a spare venturi tube, which was quickly fitted behind the engine exhaust stacks, where the hot exhaust prevented it from icing up. Then, to add to our joy, the cabin lighting system suddenly failed. All the instruments, however, had luminous dials, so that this was merely a slight discomfort. In any case, we had flashlights.

Our joys were not complete, however; in flashing the light to locate my chart, I noticed that the floor of the cockpit seemed to be covered with oil. In addition, the main oil tank gauge showed that the tank was about a quarter full. I immediately turned on the cock from the reserve oil tank to the main. Soon, I saw that the main tank was registering full, and shut off the cock. Shortly afterwards, I noticed that the main tank was again registering about a quarter full. I almost jumped out of my skin. We seemed to be losing oil badly somewhere, and oil troubles had brought me a great deal of grief during my flying career. We later discovered it was a false alarm.

In any case, we altered course to the northwest in order to get over land in case of an engine seizure.

After about six or seven hours of blind flying in the most abominable weather conditions, constantly dodging ice, we suddenly found ourselves clear of the storm area. We were too dizzy to appreciate it at the time. It slowly sank in and was an immense relief.

Looking down, I saw black and white patches which looked like early morning fog over the ocean. We throttled back the engine and came down to about 100 feet from the surface. Putting the machine into a steep turn, we shot off a white Very light signal and were amazed to discover we were over land. The black patches were scrub trees and bushes; the white ones were just great piles of snow and ice. For a while, Koehl believed we were over Greenland. I felt, however, it was simply impossible to be blown that far to the north. As we had no intention of finding ourselves back in the storm area, we decided to maintain course and await the arrival of dawn. The sun finally arose in an exceedingly winter sky and we altered course to the southeast.

After several hours flying on this southeasterly course, as we were forging our way through a very heavy blizzard, I saw through a rift in the snow storm, immediately below, what appeared to be a large frozen lake, in which a ship was iced in. It became blanked out just as suddenly as it appeared. We came down lower and again found it. It was a lighthouse on a small island completely surrounded by a frozen lake or sea. We observed smoke blowing from a chimney of the living quarters and a husky dog team lay harnessed to a sleigh just outside.

IN the center of the island was a large frozen pond onto which we decided to land. Dropping a smoke bomb, we ascertained direction and velocity of the wind—it was blowing at around 40 mph. We circled 'round, turned into the wind, throttled back and began a very cautious approach. The Bremen touched down on the ice, which immediately broke, leaving us standing on our propeller hub. We had been in the air exactly 36 and a half hours. Having taken off on Thursday, the 12th, and landing on Friday, the 13th of April, a really nice lucky day. The second foundation stone of that great Atlantic aerial bridge had been placed securely on Greenly Island in the Gulf of St. Lawrence.

I have often been asked if the flights that took place immediately afterwards were necessary. Unhesitatingly, I say they all played a highly important part in hastening the arrival of the commercial air operation over this most important air route we know today. If I am still here, I hope to be able to cross on one of the supersonic airliners which are now in the project stage of development, and which will make everything that has happened to date look slightly ridiculous. END

North American Aviation

(Continued from page 59)

slightly out of character and was burned for eight million dollars. Stargazers had forecast a private plane for every air-minded citizen, and North American, falling for the nonsense, came out with a tabby-cat version of the P-51—the Navion, a grand little airplane costing $10,000 to build and selling for $7,000. Yet the experience had its bright side. The project helped hold "the team" together—a prime consideration at the time. Dispersal of labor can be survived up to a point but when it begins to eat into key management and engineering, disaster is not far off.

But muddle through the financial morass the company did, even if '47 was in the red.

The point is that in contrast to the financial ebb tide the scientific effort was in full-flood. Salvation lay in that fact, as the evolution of the F-86 demonstrated. Another project in point was to provide the Navy with a shipboard atomic bomber. The AJ-1 Savage, a folding wing, long-range, three-place job with copious bomb bays was first designed with two reciprocating engines in underslung wing nacelles and a jet engine aft in the fuselage. Variously, the plane was modified for reconnaissance, for attack and finally as a tanker for air-to-air refueling. Navy had 143 in service. It was a good airplane, but the original idea of marrying piston and jet power was unfeasible. Yet, that had to be explored.

As the decade of the forties waned, free world illusions in regard to "the bear that walks like a man" began to dispel. There was increasing talk about defense. That we had been mousetrapped was self-evident, but confession came hard. Nineteen-fifty dawned with the aircraft industry producing about 2,700 military planes annually.

North American had a number of experimental aircraft in the works—the XA2J-1, a Navy turboprop bomber; the XSN2J-1, a Navy piston-engined trainer; the YF-93A, an Air Force fighter—none of which reached production. One which did, was the T-28, an Air Force trainer and its subsequent Navy counterparts, the T-28B and C. First flown in '49, the T-28A was manufactured at Downey to the number of 1,195. In '53, Navy bought a "B" version (490 of them) and 299 T-28C's. Production in the meantime was moved from Downey to Columbus, Ohio.

DURING this period, the company was reorganizing within, getting set and shaken down management-wise to implement the scientific character which was maturing. At the top, Lee Atwood, in '48, became President and "Dutch" moved up to Chairman of the Board. The occasion was marked by a presidential Merit Citation of both "Dutch" and Lee. The Air Force cited Kindelberger in 1953 for Exceptional Civilian Service. His citation said in part: "Exceptional service for 40 years as an engineer, designer and producer of military aircraft—no peer as a designer of airframes for fighter aircraft—by applying scientific techniques he revolutionized the aviation industry."

Additional to Inglewood, another production facility now was acquired at Downey, Calif., and in Nov., '50, a second at Columbus, Ohio. This latter marked North American's inauguration of the divisional concept of management. Columbus, charged with fabrication of the T-28 trainer and production of Navy's FJ-2, -3, and -4 series, looked to Inglewood only for policy decisions. Acquisition of a modification center at Fresno, Calif. followed leasing of the Naval Industrial Reserve Aircraft Plant at Columbus. Inglewood, at the time, concentrated on F-86's for the Air Force.

Outbreak of the Korean conflict in '50 was a tragedy, as is all conflict, but there were providential angles. Finally and fully, the Soviet Union and Communism stood nakedly self-revealed as dedicated to world conquest. Defense talk was translated into action. The aircraft industry again began to roll and this time it had greater depth and breadth in science. In prospect, at least, were weapons systems rather than airframes and engines; intercontinental guided missiles and rockets with atomic warheads; study of space by exploratory satellites in orbit.

North American inaugurated the Century series of fighters with the Super Sabre, F-100. There is probably a general tendency to think of the Super Sabre as

(Continued on page 152)

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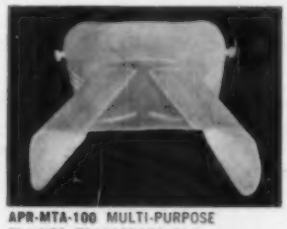

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(Continued from page 151)

merely a perfected Sabre. Such is not the case. I would estimate that the F-100, the first aircraft to live wholly in supersonic environment, was as much of an advance over the F-86 as that plane was over WW II conventional fighters; and it offered even greater versatility in modification for special utilizations. This is not the place for technical discussion, but if the reader is interested in scientific evolution of aircraft, I suggest a study of the F-100 over the F-86 as a fertile field. It was notable enough to win "Dutch" the Collier Trophy.

By 1950, North American was launched in the intercontinental missile business. The Navaho was planned in three steps—first, a recoverable jet bird; second, a ramjet bird with a rocket booster; and finally, a 5,500-mile-range ramjet vehicle with rocket boost. Evolution of the Navaho produced a volume of basic knowledge in design, electronic control and inertial guidance. By '55, the work had grown to such broad proportions that from the Missile and Control Equipment organization at Downey, separate divisions were split off to deal with electronic and electromechanical (Autonetics); rocket propulsion (Rocketdyne); atomic energy (Atomics International); and missile airframes (Missile Development Division). Much of the knowledge acquired in these fields was applicable to aircraft as well as missile systems. For example, such vehicles as the F-100, the X-15, and the projected B-70 have profited in vast measure from this diversified experience.

F-107A

As previously noted, North American first cut its eyeteeth in atomics in '46 by an Air Force-sponsored study on missile propulsion. When that study was completed, the company retained the specially engaged scientists and developed its own atomic capabilities. A series of contracts with the Atomic Energy Commission, beginning in '48, resulted in production of two low-power reactors in '52-'53. These research units became laboratory tools for production of industrial reactors. In line with management policy, nuclear activity was concentrated in its own division in 1955—Atomics International, and housed in a new facility at Canoga Park, Calif. Within several years almost a score of reactors had been built for medical, industrial, and educational enterprises.

Meanwhile another division, Rocketdyne, had come into being and was likewise domiciled at Canoga Park. The Navaho had required a 120,000-pound thrust liquid-propellant rocket engine which North American had designed and built—more than twice the thrust of the German V-2, yet only a beginning. In '53 a two-unit system of 240,000 pounds thrust was fired and an engine of over 400,000 pounds thrust was designed. Additionally, development of airborne ordnance rockets and liquid-fuel rocket engines for boost in aircraft under combat conditions were manufactured. A rocket test site set-up in a remote area of the Santa Susana Mountains was one of the most spectacular installations in the world.

Despite all the change, however, the stability of top management was remarkable. Some of the 22 company officers had been with North American since the beginning of manufacturing operations in 1934: J. H. Kindelberger; J. L. Atwood; Gerald Brophy; C. J. Gallant; R. A. Lambeth; J. S. Smithson; L. L. Waite; Raymond Rice and J. W. Young. Another half-dozen had been on the team since before the war—J. G. Beerer, A. T. Burton, Rulon Nagely, E. D. Starkweather, L. R. Taylor, and M. R. Van Camp. A third

T2J-1

group, with approximately 15 years service each, had joined the company to further the various expansion programs—W. H. Cann, W. M. Darling, S. K. Hoffman, J. R. Moore, and Doctor C. Starr. W. H. Yahn was a ten-year man and J. B. Pearson, Jr., the only relative newcomer.

One other pertinent factor I have noted in a study of the company's personnel—that while supervisory talent bulks largest in the age brackets from 35 to 50, there is a hard core of long-employed veteran talent whose practical experience has been the equivalent of a great volume of formal education—even in the sciences.

Another notable feature of North American's operation has been an ability to serve land-based and seaborne airpower with equal effectiveness. The root of this ability I judge to rest in exceptional design effectiveness supplemented by a thorough understanding of practical military requirements. But whatever its source of origin the ability has been outstanding.

The FJ series of Naval fighters, counterparts of the Air Force F-86 series, would be one of numerous examples in point. The FJ-2 was fundamentally an F-86E with ability to operate from aircraft carriers. The FJ-3 squeezed out greater range by replacing leading edge slats with more tankage in extended leading edges. The FJ-4 went still a step farther in range by redesign of the wing for integral tankage. The FJ series of Navy aircraft was actually in production almost as long as the F-86 series. Columbus turned them out from '51 to '58.

In '56, North American was awarded a $90 million contract, largest aircraft expenditure in Naval history, for development of a carrier-borne attack system—the A3J Vigilante. A fully automated weapon, the Vigilante combined the capabilities of a mach 2 fighter with those of an atomic bomber. This is a fantastic achievement even considering the revolutionary advance in carrier techniques inclusive of canted decks.

Successively increasing military budgets became of acute political concern as the '60's approached. The national administrations had failed to discipline inter-service rivalries. "Brush" war versus "Big" war was a bone of contention. Leadership had not the fortitude to lay down the law on "Brush" wars—or else. An honest, humane concern to help underprivileged little people attain and maintain freedom was sorely abused—became in cases sheer blackmail.

Against such a background of moral and intellectual expediency, what chance to resolve realistic defense decisions? Space exploration—missile weaponry—manned strategic airpower—where should the lines of balance in effort be drawn? There have been as many opinions on these subjects as there are opinionated experts in civil government and military organization.

The sum total of national policy has been defense by jitters—excessively costly in money and reality. For better or worse every aircraft company committed to the fickle business of defense has been caught in the vortex of shifting opportunism.

At North American, the Navaho was wiped out by the Government's decision to put all eggs in the one basket of ballistic missilery. Missile enthusiasm then overshadowed strategic airpower and the B-70 Valkyrie, representing a dramatic advance in controlled global striking power, was reduced to a test project. Likewise, the F-108 Rapier, a long-range interceptor, was chopped off. Throughout the Air Force rippled reflections that the manned aircraft was in eclipse, even though at N.A.A. the supersonic Hound Dog air-to-surface missile was produced to make the B-52 more effective.

Contrastingly, the Navy's program emphasized bigger and bigger aircraft carriers featuring more and more manned aircraft of greater and greater strike and intercept potential; and the Army's pro-

T-28B Prototype

gram emphasized organic employment of manned aircraft from fighting helicopters to logistic freighters.

The one advantage possibly inherent in the contradictions of American defense policy is that the Soviet may be as confused by it as are the American people.

North American has had other arrows to its bow than manned aircraft. High-thrust rocket engines of single and multiple chamber variety put out a million and a half pounds of thrust; and this is all that as yet appears to public gaze. It will be recalled that the Rocketdyne Division's Jupiter-C engine provided the first stage power to hurl America's first orbiting satellite, the Explorer I, into space. It was the Autonetics Division's inertial autonavi-

gators that contributed largely to Navy's brilliant submarine exploration of under-ice northwest passage. We might magnify these better-known projects by many others less well known if our purpose was the history of North American rather than portraiture of the corporation.

One last project we must mention, probably as near to the heart of "Dutch" Kindelberger as any North American has ever sponsored—the X-15, an involvement of man and machine exploring conquest of the thermal frontier, traveling in near space and re-entry to earth by human control from the cockpit. I regard this as a more solid approach to defense ends than any other astronautical activity because it furnishes knowledge of areodynamics, physical capabilities, sub-orbiting possibilities for useful reconnaissance and other values not exploited by capsule vehicles—nor is this to discount the exploratory benefits of the more-spectacular missile flights.

In conclusion of this series of articles on North American, an Industrial Giant of the Air Age, I can only express the hope that the reader has gained the impression of determined, dedicated, resourceful, imaginative men in action. The ultimate genius of "Dutch" Kindelberger has been to bring and hold around him men of like qualities—engineers, test pilots, mechanics, scientists, supervisors, financiers. Boundless energy, intellect to dream, will to endure, courage to compete—these qualities must permeate many if a corporation is to have such a place in history as has North American. Not that he has administered a billion dollars' worth of defense funds or that North American has produced over 56,000 defense aircraft and become a bulwark of scientific defense power is Kindelberger's achievement. That he and his have been minutemen for a slumbering and trustful nation of free people is more historically significant. END

Rotary-Wing Aircraft

(Continued from page 29)

growth of the scheduled helicopter airlines is a 34 per cent increase recorded in the number of passengers carried in 1960 over the preceding year by Los Angeles Airways, Inc., Chicago Helicopter Airways, Inc. and New York Airways, Inc. They flew 366,000 passengers in 1959 and an estimated 490,000 in 1960.

Stanley Hiller Jr., president of Hiller Aircraft Corp. and chairman of the Aerospace Industries Assn. Helicopter Council, cites a report prepared for the FAA by Human Sciences Research, Inc. on the cumbersome and time-consuming methods of airport transportation now in existence at most terminals.

The report points out that airport transportation time accounts for from 22 to 65 per cent of the total average travel time. In some short-haul cases, travel times between the city and air terminals actually exceed air travel time.

But the Civil Aeronautics Board, wishing to avoid additional subsidies to sustain new scheduled helicopter operations, has been reluctant to authorize new service "until such time as a more economical helicopter

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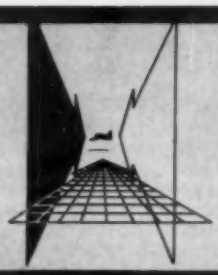

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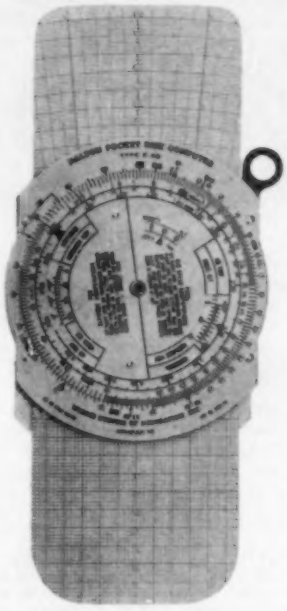

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(Continued from page 153)

type can be produced . . ."

Helicopter manufacturers—foremost among them Sikorsky with the S-61L and S-62, Bell with the 204B and proposed 205, and Boeing's Vertol Division with the Boeing-Vertol 107, are offering the new generation of turbine-powered aircraft as the answer for new levels of economical, self-sustaining operation in airport transportation.

Another field where a quick-starting, agile, fast-moving aerial rescue craft such as the helicopter shapes as a major new tool is in airport crash rescue work.

The Kaman H-43B Huskie helicopter (see July FLYING) has already demonstrated its effectiveness as a specialized crash rescue aircraft. It is equipped with "bear claw" landing gear for rough terrain and carries a 1,000-pound fire suppression kit. This aircraft has proven itself in Air Force operations and holds the promise of important rescue capability at the nation's civilian jet ports. It is performing air rescue duty at over three dozen Air Force bases throughout the country.

The rotorcraft has also been selected to be used as a flying electronics platform to simulate missile launch conditions for test and calibration of guidance systems at the nation's Titan ICBM bases.

Following are some of the highlights of present activity and forecasts for the future by major U. S. rotorcraft manufacturers:

SIKORSKY AIRCRAFT. Although major emphasis continues on military production, significant moves are being made in the

Sikorsky S-61L

commercial and airline field.

Testing of the dynamic components of the all-purpose S-64 Skycrane transport helicopter began in August, and the first flight is scheduled for next March. The giant rotorcraft will be powered by a pair of Pratt & Whitney JFTD-12 turbine engines of 4,050 shp each.

Among the tasks envisioned for the S-64 are transporting commuter passengers by detachable pod, positioning power line towers and transferring ship cargo to dockside. Demonstrations of the Skycrane's capability for the logging, construction, air freight and power transmission industries is scheduled to begin in late 1962.

Meanwhile, however, the piston-powered S-58 is proving itself a valuable tool in the power transmission industry by performing tasks ranging from equipment and supply transportation to planting transmission line poles and stringing wire.

Among Sikorsky entrants to the turbine-powered fleet are the amphibious S-62s, which already have begun service in commercial operations and with scheduled helicopter airlines. The single-turbine S-62s have been delivered to Petroleum Helicopters for offshore work in the Gulf of Mexico, World Wide Helicopters for similar operations in the Persian Gulf; the Canadian Dept. of Transport for lighthouse resupply, and to Okanagan Helicopters for supply missions to northern radar installations.

The 10-passenger S-62 also launched the new San Francisco-Oakland Helicopter Airlines passenger operation in June. The service's two rotorcraft set an airline record during the first month by carrying 331 revenue passengers in one day on June 30.

The commercial counterpart of the Navy HSS-2 (which set an international speed record of 192.9 mph) is the S-61L, a 25-28 passenger helicopter powered by twin turbine engines. The S-61L has a top speed of 147 mph. This rotorcraft, which has a

Umbaugh Gyroplane

payload of approximately four tons, is expected to cut present-day seat cost per mile almost in half in airline operation.

Both Los Angeles Airways and Chicago Helicopter Airways have ordered four of the new turbocopters each, with delivery of first aircraft this year.

Sikorsky also is discussing with trunk airlines feasibility of a turbine-powered helicopter larger than the S-61L for use on short-haul helicopter feeder routes.

HILLER AIRCRAFT CORP. A new six-place helicopter—the Model 1099—is the latest aircraft to be introduced by Hiller, and the company's first turbine-powered rotorcraft. Powerplant will be a Canadian Pratt & Whitney PT-6 turbine producing 450 hp. Aft clam-shell doors are incorporated on the prototype for easy passenger and cargo access. Both military and civilian markets are envisioned.

Other aircraft currently in production are the 12E and E4, respectively three- and four-place rotorcraft. Ceiling of each is augmented significantly by high compression piston engines on an optional basis.

The first helicopter purchased by the U. S. Forest Service, long one of the largest users of chartered helicopters, was a Hiller E4. The Forest Service makes extensive use of helicopters in fire-fighting. The four-place E4 "station wagon" is derived from the basic 12D airframe. The 12E can be converted to the E4 at the factory or by conversion kit.

In addition, new Army flying crane requirements have spurred interest in Hiller's STORC proposal. The self-ferrying concept is aimed at eliminating time-consuming and expensive transportation of conventional crane helicopters to front line areas.

The Hiller aircraft would have a rotor diameter/wing span of 120 feet, a gross weight of 60,000 pounds in helicopter configuration and 72,000 pounds in fixed-wing configuration. Power would be four turbojets of the Continental J69-T-29 type mounted in pairs in the blade/wing tips.

Hiller points out the tip power concept eliminates the need for heavy, complex gear trains and eliminates the anti-torque problem.

The aircraft would fly itself across oceanic distances to wherever it is needed—in fixed-wing configuration. Then on landing at a forward area, one wing would be turned over and locked in position to act as a rotor blade.

The Vought-Hiller-Ryan team has been selected to develop a tri-service tilt-wing VTOL transport. Five prototypes will be constructed for the program.

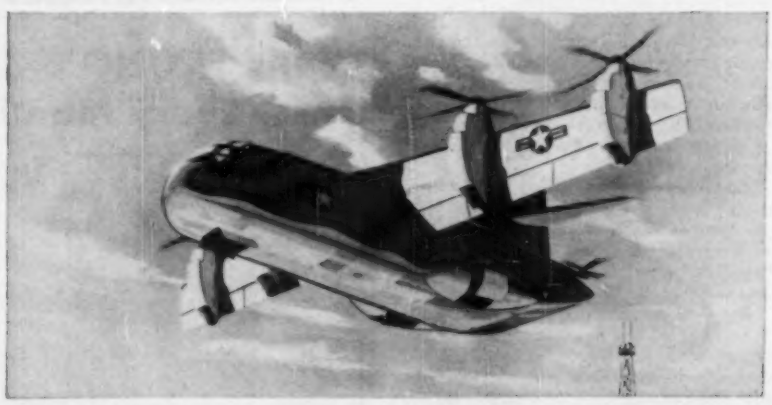
BELL HELICOPTER CO. envisions itself as having emerged from its first generation of aircraft into the second with the turbine-powered 204B and its military counterpart, the HU-1 Iroquois.

However, its Model 47 design series, which originated in the 1940s, remains a significant cornerstone of company operations with continuing improvements on the basic design. A Model 47 in 1946 became the first commercially certificated helicopter.

Of approximately 3,000 Model 47s built, nearly half have been commercial.

Two of Bell's 47Js have been fitted with the lightweight (128 pounds) Allison 250-C2 turboshaft rated at 250 shp. They are flying as testbeds for the Navy.

Bell sees a wide potential for its 10-passenger turbine-powered 204B, which offers a top speed of 147 mph with a hovering ceiling of 17,600 feet, as well as for the 15-passenger Model 205 now under development and scheduled for 1963 production as the Army HU-1D.



Tri-service tilt-wing VTOL transport will be developed by Vought-Hiller-Ryan team.

The company reports that unit and dollar volume sales for 1961 remained approximately the same as for last year, although makeup was different. Exports dropped somewhat from 1960, but this was compensated for by an increase in sales within the United States and Canada.

While expecting the domestic market to hold its own next year, Bell is looking forward to an increase in foreign sales of the 204B. The company reports a growing backlog of orders for delivery next year, and eight 204Bs have been sold to the Australian Air Force. In Italy tooling up for production of the 204B under a license arrangement is under way, and the rotorcraft will be powered by a de Havilland Gnome engine, equivalent of the GE T58.

Negotiations are currently in progress with Japanese representatives for 204B licensing in Asian markets.

Bolstering advances in the rotary-wing field by these major manufacturers are achievements by other firms with aircraft designed to fill a wide variety of needs.

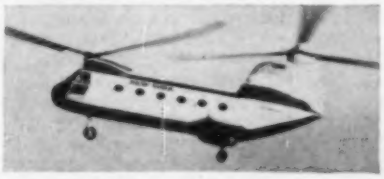
Manufacturers of lightweight compact rotorcraft are beginning to expand operations. Hughes Tool Co., Aircraft Division is offering the four-place 369 in the Army light observation helicopter competition, marking the first addition to its two-place piston-powered 269A.

The 269A, powered by a 180-hp Lycoming engine, has a 200-mile range at an 80-mph cruise speed. It is priced at $22,500.

The Brantly Helicopter Corp., builder of the 180-hp two-place B-2 helicopter, is considering production of a six-place rotorcraft using two engines and two B-2 rotors. The Brantly B-2 is priced at $19,950.

In the offing in the gyroplane field is the tandem seating two-place Umbaugh Aircraft Corp. Model 18, which received FAA certification on Sept. 12. Engineering is also under way on a new four-place model, and consideration is being given to another seating six, Umbaugh reports.

For the Model 18 Umbaugh has established a production organization to manufacture the Umbaugh Aircraft and thus become the prime contract with its own plant. This is in contrast to its past approach of seeking a major producer for manufacturer. The program established is to develop a high production rate for volume production, Umbaugh reports.



Boeing-Vertol 107

In the large rotorcraft field, Vertol Division of Boeing received a Class I provisional type certificate from the FAA for the 25-passenger Vertol 107 on June 29. New York Airways has ordered an initial group of five of these twin-turbine rotorcraft. The Airways, which has applied for authorization to inaugurate 107 service between downtown Philadelphia and New York City, is conducting pilot training and route evaluation in the 107. END

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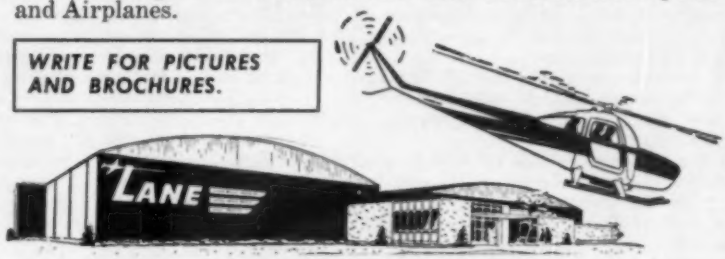

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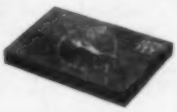

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Aviation Fuels

(Continued from page 49)

divert finely dispersed water.

At New York International Airport, for example, incoming jet fuel is filtered as it is transferred from boats into storage tanks; filtered again as it goes into trucks and a third time during fueling of the aircraft from the trucks.

Storage tanks incorporate floating roofs and floating suction as a further cleanliness measure, and kerosene fuel is allowed one hour per foot settling time.

One question yet to be answered, however, is the precise measure of cleanliness necessary for proper turbine operation. Time and experience will tell.

Another problem posed in the switch to kerosene fuels was selection of the optimum type. The turbine engine eliminated the need for different fuel octane ratings developed for reciprocating engines, but no one universal fuel appeared as a standard for jet operations. Instead, several were offered with varying properties, such as flash point, freezing point, and of course availability.

The military has selected JP-4 as its principal fuel—one that actually represents a compromise between performance and availability. Essentially 25 to 35 per cent kerosene and 65 to 75 per cent gasoline, it uses a low-octane gasoline and has been made available by the petroleum industry in very large volume at economical prices. The oil industry is supplying this fuel at the rate of 124 million barrels per year to the U.S. government alone.

According to W. S. Mount of Mobil Oil Co., JP-4's potential for further expansion in an all-out war effort was an important feature in its development and continues as a factor in extending its life in the future. By rationing of gasoline and control of middle distillate consumption, he says, refinery runs could be expanded rapidly from today's volume, approximately three per cent of U.S. demand, to about one-third of a typical refinery crude run.

Two other principal military fuels are JP-5, a kerosene type with a high flash point (minimum 140 degrees F) designed for use on aircraft carriers to minimize fire hazard; and JP-6, a kerosene type used for development of supersonic aircraft. Both of these find only small volume use.

Two other military types, JP-1 and JP-3, are now virtually obsolete.

The civilian air transport industry had somewhat different objectives from the military in seeking a turbine fuel. Prime goals for the airlines are performance, economy and safety. JP-4, because of its gasoline mixture and resulting lower flash point (flash point is the temperature at which a fuel gives off sufficient flammable vapor to ignite) is more of a potential fire hazard.

In a landing or takeoff accident where the aircraft settles down on collapsed gear, or rolls off the runway, the damage can result in ruptured fuel tanks. A volatile fuel such as gasoline or JP-4 will tend to spread an envelope of flammable vapor around the aircraft. Should there be an opportunity for ignition from heated engine parts or static electricity, fire might easily break out and spread quickly.

But with kerosene the absence of a large envelope of flammable vapor reduces the chances of a rapid spread of any fire before passengers can be evacuated.

A. R. Ogston of Esso Export Corp. notes as an example that an airline turboprop transport crashed during takeoff at London in 1955. All four propellers and two entire engines were torn off and the aircraft heavily damaged. The airplane came to rest in a pool of over 1,000 gallons of kerosene fuel. Two small fires in two of the engines were quickly extinguished and all passengers safely evacuated. The airline and the Air Registration Board (British counterpart of the FAA) were convinced that had the fuel been gasoline instead of kerosene, a major fire would have been inevitable.

On the other side of the ledger, however, might be cited the landing accident of a jet transport in Denver this July. Seventeen persons lost their lives in the conflagration that resulted after the tires blew out from locked wheels following hydraulic difficulty.

The picture is by no means a clearly defined one on the safety question, and engineers point out that under some conditions kerosene is more hazardous than JP-4. The argument is that at high altitude with fuel well above the ambient temperature, an explosive vapor forms in the aircraft's fuel tanks with kerosene while under similar conditions with JP-4 the vapor would be too rich to be within the explosive range.

As far as fuel energy is concerned, JP-4 yields about 5,500 less BTU per U.S. gallon than the denser kerosene, even though the average BTU per pound content of JP-4 is about 100 BTU higher than the average kerosene. But in view of the fact that fuel is bought by the gallon on a volume basis, kerosene gets the nod on this point.

On the other hand it is easier to control the cleanliness of JP-4 because its lower density and viscosity result in faster settling rates. However, its composition causes it generally to contain more dissolved water at a given temperature than kerosene.

As a result of the various pros and cons, there has been some debate as to which fuel to use for airline operation. The turbine engine will accept either interchangeably.

Perhaps the most important factor in a decision is cost. At present the kerosene fuels are not Federally taxed in the United States, as is gasoline. And airlines estimate that turbine fuel represents as much as a third or more of direct operating expenses. It is for this reason that the airlines regard proposed introduction of kerosene taxes with apprehension.

However, there are other factors to be considered, especially in overseas usage. The Federal two-cent per gallon tax does not apply to foreign fields, and military groups such as NATO and SEATO result in high availability of JP-4 in some overseas areas.

Another important factor is freezing point. Temperatures plummet well below

CHECK YOUR FUEL

THE FAA's BUREAU of Flight Standards has been giving a careful eye to the problem of fuel contamination in light airplanes, and their care has turned up some startling facts.

When it noticed that an increasing number of lightplane accidents were caused by water and dirt in the fuel, the Bureau cut a typical highwing aircraft out of the herd and began testing it. The investigators put only half a tank of fuel in the conventional-gear airplane and deliberately added three gallons of water to the fuel. After waiting a few minutes for the water to settle, they opened the fuel strainer and drained 10 ounces of pure gasoline, a little over half a pint of fuel, before the first bit of water appeared.

Feeling that they might be on the trail of a real accident-causer, the Bureau investigators lifted the tail of the airplane to simulate the tricycle-gear version of the same aircraft. They filled the tanks to the one-half mark again, and this time added only one gallon of water. More than a quart of good fuel went through the strainer before the first drop of water appeared. After all traces of water had gone through the strainer and they were draining pure fuel again, they checked the quick-drain installed on the bottom of the fuel tank. There was another half-pint of water still in the tank.

For a first-hand look at what was happening, the investigators built a transparent working model of the fuel system and watched the water in action. Obeying the textbook, the water sank to the bottom of the half-full tank, but it did not flow down the fuel lines to the strainer until all the fuel in the lines had been drained away. In the model as in the aircraft fuel system, the last half-pint of water stayed in the tanks and could be drained only by a quick-drain on the tank itself.

Drain plugs of some other lightplanes were checked, and it was found that many of the plugs had not been removed since original installation by the manufacturer, and had a substantial collection of dirt above them in the fuel tank.

The procedures that the Bureau recommends are:

- Check the fuel tanks as well as the fuel strainer for dirt and water on the preflight inspection. They suggest the use of quick-drain valves on the fuel tanks.
- Avoid fuelling your airplane from cans and drums. If it cannot possibly be avoided, that fuel should be strained through a good chamois.
- Periodically inspect and clean the fuel tank outlet finger strainer and carburetor screen, and occasionally flush the carburetor bowl.
- Store your airplane only with its fuel tanks completely filled.

freezing on high altitude flights, and time at altitude on long overseas flights compounds the problem of exposure.

JP-4 fuel offers an advantage here, because it has the relatively low freezing point of minus 76 degrees F. The airlines, however, mainly are using two major types of kerosene fuels, rated on freezing point.

One of these, type A, has a freezing point of minus 40 degrees F; the other, type A-1, minus 58 degrees F. For the most part the higher freezing point fuel is used on domestic flights and the other on long overseas operations.

In reality, however, it is a moot point as to whether such low fuel temperatures are ever reached in actual operations, and one airline reported minus 18 degrees the lowest temperature it ever recorded, while two others listed 33 degrees as the low mark.

As for the formation of ice from water particles in the fuel, the use of heated elements on aircraft fuel systems has to some extent counteracted this menace.

But difficulties may still appear in a number of ways, such as freezing of valves, lines or icing of boost pump inlet screens or fuel strainers. Attempts to keep fuel free of water during ground handling may be rendered useless by water accumulation from open tank vent lines, either on the ground or while in flight.

One proposal designed to provide protection throughout the fuel system, up or downstream from heater elements, is a jet fuel anti-icing additive. One such additive developed by Phillips Petroleum Co. and known as PFA 55 MB was approved by the Air Force in November 1960 for use in SAC aircraft.

But looking into the future, while fuel icing ironically remains a problem for today's turbine-powered aircraft, fuel heating poses a thorny problem for the supersonic transports of tomorrow. Ram air heating may contribute 50 degrees F to a conventional subsonic jet flying at Mach 0.8. But at Mach 3, according to W. G. Dukek of Esso Research and Engineering Co., temperature of the air around an aircraft reaches about 640 degrees F.

Some of the heat absorbed by the aircraft is radiated into space, but the bulk of it is transferred to the fuel as it sits in tanks or while moving through the fuel system.

Here arises the problem of thermal stability, and technologists face the difficult problem of controlling high temperature oxidation reactions—at reasonable cost.

As designers plan for the future, they also must consider the problem of fuel volatility control in supersonic aircraft. The high temperatures accompanying high mach flight can cause the fuel to exert considerable vapor pressure on the inside of the tank. Therefore it is necessary either to select a fuel of low volatility, or design tanks capable of withstanding the pressure.

These are just a few of the obstacles in the way of finding satisfactory supersonic jet fuels. Nevertheless they will be overcome, and in all liklihood with petroleum products.

The so-called high-energy or chemical fuels expected to herald the supersonic age have a dim future, at least at present out-

(Continued on page 158)

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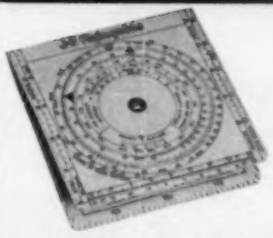

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NOVEMBER 1961 FLYING ADVERTISERS' INDEX

ADVERTISER	PAGE NO.
AC Spark Plug	81
Academy of Aeronautics	128
Acme School of Aeronautics	146
Adams Aircraft Sales, Inc., Jack	110
Aero Commander, Inc.	111
Aero-Electronics Assoc.	128
Aero Products Research, Inc.	151
Aero-Progress, Inc.	108
Aerotronics, Inc.	150
Air Associates, Inc.	147
Aircraft Radio Corporation	11
Airline Operations Training, Inc.	157
Airwork Corporation	12
American Airlines	21
American Flyers	149
American Mercury Insurance Company	119
Andrews, Inc., H. J.	155
Bahamas Development Board	140
Beech Aircraft Corp.	86, 87, 88, 89
Bell Helicopter Company	5
Bendix Products Division	105
Bensen Aircraft Corp.	155
Borer Aircraft Services, M. R.	128
Brantly Helicopter Corporation	110
Brittain Industries, Inc.	109
Cessna Aircraft Co.	13, 14, 15
Champion Aircraft Corporation	113
Champion Spark Plug Company	16, 17
Collins Radio Company	19
Continental Aviation and Engineering Corporation	82
Continental Motors Corporation	102
Desert Air Hotel & Resort	148
Don Juan Watch Bands	110
Dot Airtronics	136
Electric AutoLite Company, The	131
Embry-Riddle Aeronautical Institute	4, 10, 80, 106
Erg Corp.	138
Fowler Aero Publications	18
Fuji Photo Optical Products, Inc.	118
General Electric	9
Gibcraft	150
Graubart Aviation	144
Grumman Aircraft Engineering Corporation	94, 95
Gulf Oil Corporation	121
Helicopter Research Co.	150
Hiller Aircraft Corp.	101
Hughes Tool Company, Aircraft Division	134, 135
Humble Oil and Refining Company	3rd Cover
Indiana Technical College	144
Insurance Co. of North America	127
Island Airmotive, Inc.	137
Jeppesen & Co.	93
Kane Aero Equip't.	120
King Radio Corp.	79
Lane Aircraft Company	97
Lane Aviation Corporation	155
Leitz, Inc., E.	92
Lycoming Division, Avco Corporation	83
McCauley Industrial Corp.	141
Manger Hotels	145
Mitchell Industries, Inc.	96
Mooney Aircraft, Inc.	1
Motorola Aviation Electronics, Inc.	6, 7
National Aeronautical Corp.	107
Northrop Institute of Technology	84, 114, 139
Nova-Tech, Inc.	129, 130
Pan American Navigation Service	100
Parks College of Saint Louis University	117
Parmele Navigator	92
Phillips Petroleum Company	2nd Cover
Piper Aircraft Corporation	91
Pratt & Whitney Aircraft	123
Precision Imports, Inc.	148
Radio Corporation of America	98, 99
Riverside Records	142
Rock Sound Club, The	157
Ross Aero Publishers	124
Ross School of Aviation	124
Schweizer Aircraft Corp.	140
Scott Aviation Corp.	4th Cover
Shell Oil Company	103
Shinn Engineering, Inc.	144
Southwest Airmotive Co.	96
Spartan Aircraft Company	125
Spartan School of Aeronautics	143
Sperry Phoenix Company	115
Standard Oil Company of California	85
Stits Aircraft	92
Stringair Corp.	148
Todd's	144
United Air Lines	90
U. S. Air Force	133
Valparaiso School of Aeronautics	155
Walters Aviation	157
Weems System of Navigation, Inc.	153
Zahns Airport	137

(Continued from page 157)

look. The project to use boron fuels for high-speed military aircraft was scrapped and stands as a monument to the difficulty of developing a satisfactory high-energy fuel within reasonable technical and economic bounds.

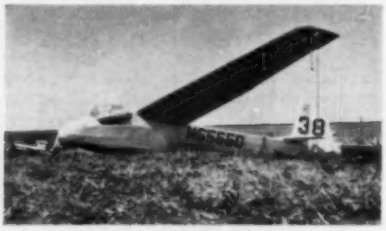
As a result the petroleum industry is surveying the future with confidence that the great bulk of air transportation will remain for many years under petroleum power. END

Soaring Contest

(Continued from page 47)

made their turns during triangle course events.

Wichita's airmindness made for a most interesting competition. Many a participant found to his surprise that the farmer on whose field he landed was a pilot as



Cloverdale's Schleicher Ka. 8

well as airplane owner and well informed on aviation subjects. This, of course, made the task of explaining the reason for landing amid the crops less strenuous and the reception more amiable. END

FLYING CALENDAR

November 1-2—Mooney distributor and dealers' meeting; Kerrville, Texas.

November 8-9—Piper distributor and dealers' meeting; West Palm Beach, Fla.

November 11—Fly-in breakfast; trophies, antiques, homebuilts and airshow. Fairview, Oklahoma.

November 15—Beechcraft distributor and dealers' meeting; Wichita, Kansas.

November 18-19—"Sunshine" Fly-in; trophies, barbecue, skydiving. Imperial County airport, El Centro, California. Contact Ben Jones, El Centro Chamber of Commerce.

November 28-30—Aviation Distributors and Manufacturers Association 38th meeting. Jung Hotel, New Orleans, Louisiana.

Calendar items must be received by FLYING's editorial office, 1 Park Avenue, New York 16, N. Y., two months prior to the event.

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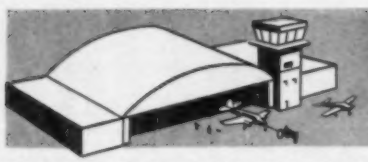

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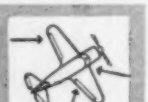

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YOUNG graduate technician, 6 years experience. Will invest $10,000 in manufacturing supply or maintenance establishment in Eastern Area. Flying, Box 264, One Park Avenue, New York 16, N. Y.

OPPORTUNITY for Manufacturers Representatives to represent famous Winslow Aerofilters—pioneer in Full-Flow oil Filters—in key areas throughout the U.S. If you call on fixed base operators, write, giving background on lines handled and territory covering to: G. A. Duemling, President Winslow Aerofilter Sales Corporation, 4069 Hollis Street, Oakland, California.

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SELLING entire personal stamp collection. All foreign. Good condition. Assorted packets of 50—25¢ and self-addressed stamped envelope. Flying, Box 261, One Park Avenue, New York 16, N. Y.

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BRIEFINGS...

(Continued from page 8)

ing out a "Blue Seal" for their certificates as they acquire enough instrument flying to get safely out of bad weather. The Blue Seal is not intended to recognize the pilot who qualifies as an "instrument pilot," but rather this special ability, to be used only in an emergency. Instrument-rated pilots automatically receive the seal. Eligible are those pilots who satisfactorily demonstrate to FAA personnel they have the required instrument competency.

Piper Apache No. 2,000 left the company's Lock Haven, Pa., runway in mid-August for Des Moines, Iowa. The milestone

Apache was purchased by Kenneth Gethmann—his second Apache—flying president of Gethmann Construction Co., of Gladbrook, Iowa. Gethmann purchased his Apache through Des Moines Flying Service.

Alaskan distributor for Fli-Lite Aircraft Skis, manufactured by Fluidyne Engineering Corp. of Minneapolis, Minn. is Alaskan Aircraft Equipment Supply, Inc. The new distributor plans to warehouse a complete stock of skis at its new Anchorage aviation supply store for ready distribution wholesale to the Alaskan-based airframe distributors and fixed base operators.

The Pioneer Finance Co. of Detroit, Mich., a leader in Mobile Home financing, has completed arrangements to enter the General Aviation financing field in cooperation with American Mercury Insurance Co. of Washington, D.C. Under its arrangement with American Mercury, Pioneer will offer to aircraft dealers a flexible financing and insurance package to cover both new and used aircraft; equipment, parts, repairs and services.

Acquisition of the General Aviation Supply Co., founded in St. Louis, Mo. in 1947, has been announced by Van Dusen Aircraft Supplies. Paul G. Bingaman, a founder and president of the firm, has been named a vice president of Van Dusen with his office remaining at Lambert-St. Louis Municipal airport. With the acquisition of GASCO, Van Dusen's operations extend to 14 locations coast to coast and the Van Dusen fleet of single and twin-engine aircraft now totals 20, flying nearly one million miles of business travel annually.

In recent realignment of its wholly-owned Standard Products subsidiary, Air Associates has announced that the former's distribution facilities at Tulsa, Denver, Wichita (Airport Site) and Kansas City, Kan.—formerly known as Standard Products, Inc.—will change their name to Air Associates, Inc. Development and manufacture of Standard's products, such as flight instruments, seat belts, AN parts and electromechanical devices, will continue at its Wichita manufacturing facilities.

Aviation headliners of 30 and more years ago were among the 300 members attending the OX5 Club's Sixth National Reunion, at Wichita, Kan. Among them was Col. Arthur C. Goebel (*right*) who showed keen interest in a 1961 twin-engine Beechcraft Travel

Air, on briefing from Vern Carstens, Beech flight operations manager. Goebel, in 1927, won the Dole Race—California to Hawaii—in the original Travel Air, a single-engine aircraft. Tours of Beech, Cessna and Boeing plants were highlights of the three-day reunion, at which E.A. (Pete) Goff Jr., official of the Link Div., General Precision, Inc., was named 1962 president, replacing Jimmie Mattern.

After competitive trials, sponsored by KSAK, government-sponsored Royal Swedish Aero Club, the Piper Colt, two-place, side-by-side tricycle-geared aircraft, has been selected as the standard airplane for all aero clubs in Sweden. An initial order for 30 Colts has been placed with Jonas Aircraft Co., New York.

Two red letter days fell in succession to Pan Am's Capt. Charles F. Blair. On August 21 last, in the uniform of a USAF-Res. Brigadier General he was awarded the Distinguished Flying Cross in Washington, D.C. in recognition of his participation in the first non-stop jet fighter flight across the North Pole (August 1959). The next day he marked his 1,000th transatlantic flight for Pan Am with Stanley Zedalis

(*right*), who was a crew member on Pan Am's first commercial transatlantic flight in 1939. Capt. Blair is also possessor of the coveted Harmon Trophy, awarded in 1952 for his solo flight in a P-51 Mustang over the North Pole. Both North Pole flights were detailed in FLYING by Capt. Blair, in August 1959 and January 1960 issues.

Charitable organizations will benefit through recent FAA ruling which permits private pilots to carry passengers for recognized fund-raising purposes. The new amendment to Part 43 provides that the sponsor of the flight notify the local FAA inspector seven days before the event. All flights must be from public airports or those approved by an FAA inspector; the pilot concerned must have logged 200 flight hours; the aircraft must meet airworthiness requirements for carrying passengers for hire; and all flights shall be daylight hours and under VFR conditions. No acrobatic or formation flying shall be done.

Timmins-Montreal delivers—The first 193 mph Super EMQ Catalina, amphibian conversion, was delivered recently to Selco Exploration Co., Ltd. by Timmins Aviation Ltd., Montreal-based aircraft modification firm. Present for the occasion were: (Left to right) Peter Lazenby, Selco, Ltd.; John O. Timmins, president; J. Morris, test pilot; Colen Mundy; all of Timmins and Selco's; Capt. L. Redman; flight engineer, S. Robertson and first officer Grant Stonehouse. Powered by two Wright 2600 engines, each developing 1,750 hp, the Timmins Catalina is now available in several configurations: passenger, cargo, executive and tanker.

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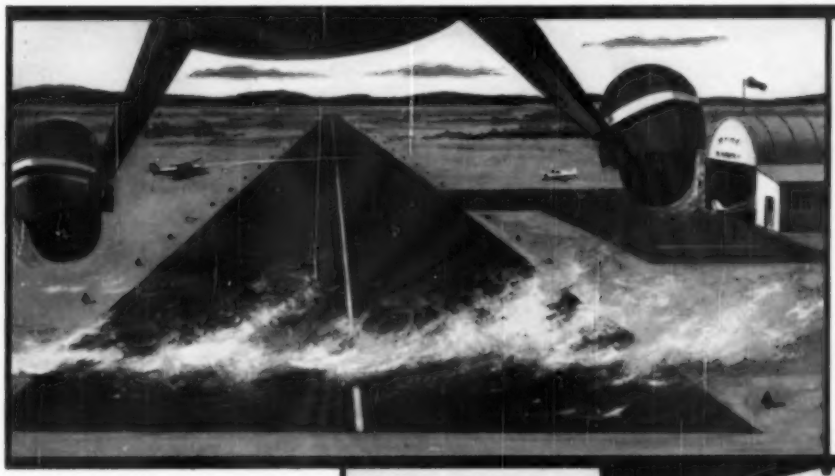
WING TIPS



WATCH FOR "GUST DUST"!

While making your approach, keep a keen eye out for low level, wind-blown dust near the runway. If it's moving in a different direction than the wind sock, you should expect turbulence or cross winds as you're touching down.

TUCK IN BEFORE TAKE-OFF!

Sounds fantastic, but many a carefree pilot has taken off with a seat belt dangling out the door of his plane. In flight, a dangling seat belt can create terrific noise – even damage – as it raps against your fuselage. So keep seat belts inside . . . and fasten 'em!

MEET A NEW OIL THAT'S ASHLESS!

New Esso Aviation Oil E is an ashless dispersant oil. Because it reduces engine deposits, it helps reduce engine wear and oil consumption. New Esso Aviation Oil E has been cleared for use by every major U. S. aircraft engine manufacturer. Next time you land, taxi over to the Esso Sign.

HUMBLE OIL & REFINING COMPANY ESSO

FLYING ABOVE TEN THOUSAND FEET

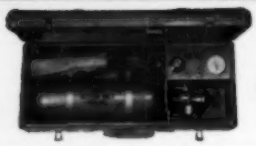
IS MUCH MORE ENJOYABLE ... It's SAFER ... SMOOTHER ... FASTER!

One of these Scott Oxygen Models will let you enjoy high altitude flight

World's simplest fixed oxygen installation.

Scott Oxygen CONSOLE

Compact. Light Weight. Safe. Lowest priced fixed oxygen system available. Simple to use — just set at cruising altitude and plug in as many masks as needed. Each outlet is an ON-OFF valve. Supplies oxygen for one to five persons.



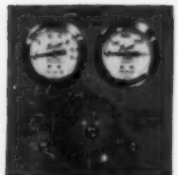
Scott AVIOX

Complete oxygen breathing equipment for four in a smart, leather luggage case. Portable — F.A.A. weight and balance data is not required. Variable regulator provides maximum oxygen efficiency. Unquestionably the world's finest portable.

Cylinder can easily be replaced for refilling or replacement.

Your comfort is "in the bag" when you fly with a beautiful Aviox.

FIXED MODELS — PORTABLE MODELS



Oxygen Regulator. Wgt. only 21 oz.

Scott "PRESIDENT"

A complete oxygen installation for five people furnished in kit form, for all aircraft. Includes Oxygen Regulator, Manifold, Oxygen Cylinder, Mask Assemblies, all fittings and necessary tubing. A convenient and efficient installation for single and light twin Aircraft.

Scott "EXECUTIVE"

A complete oxygen system — ultra compact . . . self-contained . . . no installation. The Scott EXECUTIVE has all the basic parts to provide supplementary oxygen for one or two persons to 20,000 feet. Carrying handle attached to cylinder by metal straps. Cylinder valve, manifold, oxygen regulator and gauge combined compactly in one unit. Simple to use — just turn knob, plug in masks and breathe! The low price of this complete unit will please you.

SINCE 1932 Scott FOR SAFETY - FOR SERVICE

SCOTT AVIATION CORP.

224 ERIE STREET • LANCASTER, N. Y.

Export: Southern Oxygen Co., 3 West 57th Street, New York, N. Y.
West Coast Office: Fulton-Ventura Building, 13273 Ventura Blvd. Studio City, California

SCOTT AVIATION CORPORATION

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Please send me complete information on your Fixed and Portable Oxygen Models.

Name_____

Address_____

City_____ Zone____ State____